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NATURE'S LAWS
AND THE
MAKING OF PICTURES

W. L. WYLLIE, A.R.A.

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BY

W. L. WYLLIE, A.R.A.

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EDWARD ARNOLD

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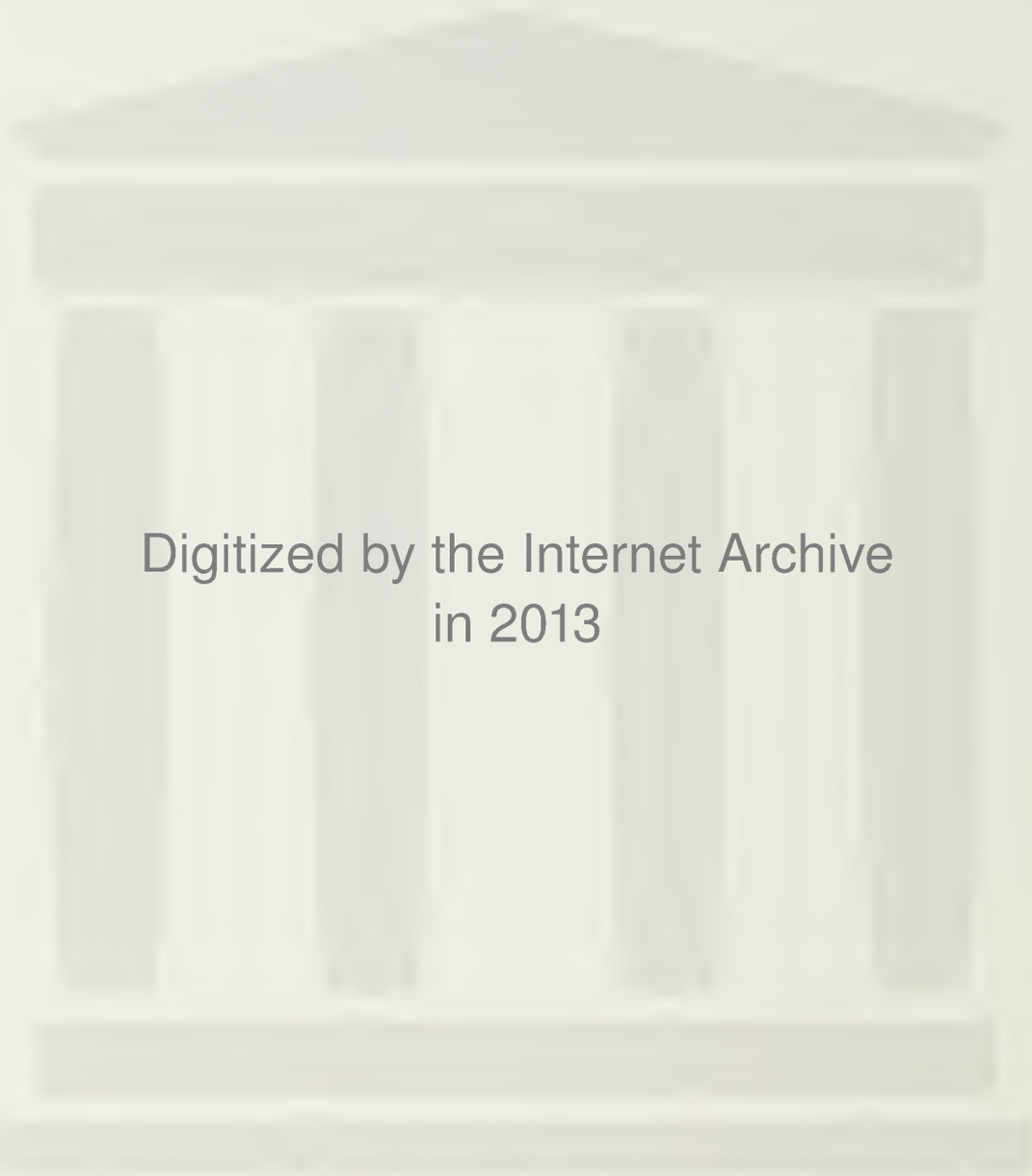
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Perspective is the art of projecting upon a flat surface the image of any object, situated at any distance, so that it may present to the eye the same appearance with regard to its surroundings as does the real object.

It is an exact science, and the truth of its rules can be demonstrated to absolute certainty ; so they can no more be ignored than can the multiplication table or the propositions of Euclid. Yet it is a fact that many artists, just because they have never taken the trouble to learn how to use these rules of perspective, abuse the whole subject ; call it a "one-eyed science" ; tell you that it has nothing to do with Art ; and even go so far as to say that, if you have to use paper and pencil to prove your case, you must be wrong.

Even among those painters who believe in a hazy sort of way in its truth, there is a feeling that it is better to leave perspective alone ; an idea that it leads them into many more blunders than it saves them from. No doubt there is a certain measure of truth in this, for the attempt to use rules, without understanding them, is apt to lead into all sorts of trouble.

In the days of the old masters there were no doubt traditions handed down from teacher to student which prevented the grotesque faults one sees to-day in every exhibition, or illustrated book or paper. There is much confusion of thought in the present time ; and the use of photography, instead of helping us to see more clearly, seems only to have led some of us into yet wilder error.

In the present book I have tried to show how the rules can be used in the construction of pictures and drawings. I have begun with very easy lessons, and the words I have used are the simplest I could find. I hope my reader will pardon me for writing as though he were a child ; my only desire has been to make my meaning as clear as possible. I trust, by commencing with only the most obvious truths, and working up gradually to more difficult problems, and finally to the principles which govern the whole science, to make my method more easy

to follow than that of many books on the same subject. I have endeavoured to remove the grounds for the charge of dulness and difficulty. I hope and believe, from my experience with my own pupils, that by carefully reading these lessons and practising their rules while working out of doors, the student will find problems become simple which before seemed hopelessly complex, and that he will be enabled to "follow nature" with truth and success.

First of all, it may be well to explain some of the terms used. *Horizon* is a Greek word meaning a boundary; it is the circle bounding the view where the earth and sky appear to meet. In most perspective drawings a line is ruled across the paper, and is used to enable the artist to draw correctly all horizontal objects, such as lines of moulding, floors, the edges of buildings of all sorts. This, though called the horizon, does not coincide with the visible horizon one sees in nature, looking over a plain or the surface of the sea. The real world is round, and therefore one cannot see a very great distance on it unless mounted on a height. If the beholder's eye is 6 feet above the water, he can only see its surface for 3 miles. Not only does one see but a short distance, but in looking towards the visible horizon one looks, as it were, downhill on every side. This lowering of the visible horizon is called the *dip* in navigation books, and though at first it might seem a matter too trifling to trouble about in making a picture, yet it is quite easy to see both dip and curve of surface when you draw from nature. Now the builder, when he makes a house, uses a level and a plumb-line, but these do not secure straight lines, for long walls follow the curve of the earth's surface. If the lines of pediment and basement could be continued straight on for a great many miles, they would show as tangents to the surface of the earth. As in most cases the buildings we are representing only extend for a very short distance, it saves a world of trouble to treat the few acres on which they stand as flat. In this case the horizon we make use of represents the plain as stretching away into infinity, and if you introduce the sea horizon into your work, it should be represented a trifle lower down than the horizon you have used to draw your near buildings by, just as the navigator makes allowance for dip. (See drawing at bottom of opposite page.)

If you are standing on the platform of a railway station when a train passes through without stopping, you will notice how the back of the rear carriage appears to contract rapidly as the train retreats. If there is a straight run of 3 or 4 miles, it will gradually diminish until it is only a speck; after that it becomes invisible—it has *vanished.* If we had drawn it at intervals of a quarter of a mile, we should have had to represent it as smaller each time; but if we could have drawn it on the principle of the cinematograph, we should have had to represent the four corners of the back of the last coach as passing along four gradually converging lines until they meet and then vanish. The back of the coach has not shrunk really, but only in appearance. The lines through which the corners have moved have really been parallel, but to the eye they have seemed gradually to come together until they met, and the eye could no longer see them. It is the same with all parallel lines. They all have their vanishing-point. The same fact may be stated in a different way by saying that parallel lines radiate from a point. I shall therefore speak indifferently of lines running to or radiating from the fixed point.

My first lesson is very simple. I will suppose that you are not upon this round world of ours at all, but upon an absolutely flat plain, stretching without break or curve as far as the eye can see. At some distance a man is standing; as you draw him you are sitting so that your eye is just on a level with the top button of his waistcoat. The horizon—that is to say, the line where plain and sky seem to meet—will pass through him immediately behind that button. What is true of him is true of every other man you can put into the picture; they will all be correct if the line passes through them at the same part of their body. I am

assuming at present that they are all of equal height.

All parallel lines there may be upon the plain, such as furrows, or lines of paving, or the shadows of upright objects, *must* vanish in a point somewhere on the horizon. That point may be a long way outside the limits of your picture, but you must prolong your horizon as far as is needful, and, fixing a point, draw all your vanishing lines to it.

The only exception to this universal law is the case of lines exactly sideways to you—that is to say, broad side on, or at right angles to your line of sight. They must be drawn parallel to the horizon, like the sun-shadows of the men in this picture.

You may say, "But there is no such thing as a plain stretching away on a dead level into infinity." Of course there is not. I have only drawn the horizon to enable me to draw the men, and the vanishing lines, in their proper places. When it has served this purpose it may be rubbed out and anything put in its place, such as hills, or houses, or the walls of a room.

What I want you to understand is that in this imaginary flat land the horizon represents infinity, or a distance so great that objects on it are too small in size to be measured—that is to say, they vanish.

The length of the shadows will depend on the altitude of the sun. I have supposed here that it is 45° above the horizon. All that I have to do is to draw rays at an angle of 45° from the men's heads to the ground, and they will cut the shadows the right length. If your eye were level with the tips of the men's noses, you would draw all your men with their noses just touching the horizon.

Suppose that when you draw your men you are not on the ground, but raised so that your eye is 9 feet high. It is half as high again as a man ; therefore the horizon will be half the height of each man above his head. That is to say, you can go on putting as many figures as you please into your picture, and they will all be correct so long as the tops of their heads are two-thirds of the distance from their feet to the horizon.

I will also suppose that you are looking towards the sun, instead of, as before, having it on one side of you. You will see that the shadows of all upright objects radiate from a point on the horizon exactly under the sun. Rays from the sun itself may be used to cut all these shadows to the correct length. If the object throwing the shadow be not upright, or overhang, like the burden on the ass, you have only to drop upright lines from the corners, and cut their shadows to the proper length by rays of the sun.

These rays are a good example of parallel lines vanishing or appearing to vanish. For so great is the distance of the sun that for all practical purposes we may treat the rays we see as parallel. Yet on any misty day you can see them radiating from the sun.

On some days, if you turn your back to the sun, you may see the rays vanishing away towards the shadow of your head on the ground, as on the right-hand side of this example. These rays may be used to cut the shadows to the proper length, just as in the previous instance. I want you to notice that the shadows of upright objects now run towards a point on the horizon exactly over the shadow of your own head. I am supposing that you are sitting, and that consequently your eyes are level with the waists of full-grown people; the horizon will pass through their waists. If you want to put in a child, whose head in real life only comes up to an adult's waist, in your picture it must only come up to the horizon. If its head would come up to an adult's shoulder, in the picture it must be as much above the horizon as an adult's shoulder would be.

Observe, too, that some of the shadows appear to fall from the right and some from the left. I once had a picture returned to me to correct this "mistake." But it is perfectly correct. The shadows are parallel lines, and are bound to converge; and they do converge, as you may see any day on a piece of flat ground when the sun is low.

On a like principle, a rainbow is always a circle round the shadow of your own head; the sun's rays, like the spokes of a wheel, running to the vanishing-point in the centre. No two people can see exactly the same rainbow; each sees one round the shadow of his own head.

Now suppose your eye to be 24 feet above the level of the plain. You will make your men just such a size that it takes four of them to reach the horizon—that is to say, that the height of each full-grown man will be one-quarter of the distance from the ground he stands on to the horizon.

You will notice that all the shadows of the people in this drawing run towards a point on the horizon to the left of the picture. From its elevated position your head would cast its shadow exactly under this point.

It is usual in books on perspective to mark the beholder's shadow by a point only, and to call it *V.P.S.R.*, *i.e.* vanishing-point of the sun's rays. In the present case I used such a point, and ruled rays to it to cut the shadows of the people to the proper length. Both points are on the left, outside the limits of the picture.

Should you wish to draw figures on a slope, the same rule may still be used ; but you must now make, as it were, a slanting horizon to correspond with the sloping plane on which your figures are to stand. This is called in perspective the "vanishing-line of the plane."

You will recollect that I am dealing up to now with an imaginary earth stretching without break or curve into infinity. So you will find all the hay-makers obeying the rules we have established for their height—the furrows vanishing to a point in the far distance ; the shadows cast by the men radiating from another point on the right, just under the sun.

As a matter of fact, however, sloping plains in nature soon curve into valleys or hills ; so as soon as you have used the vanishing-line to draw your people and their shadows in correct proportion, and to make your furrows converge to the vanishing-point, you will rub it out.

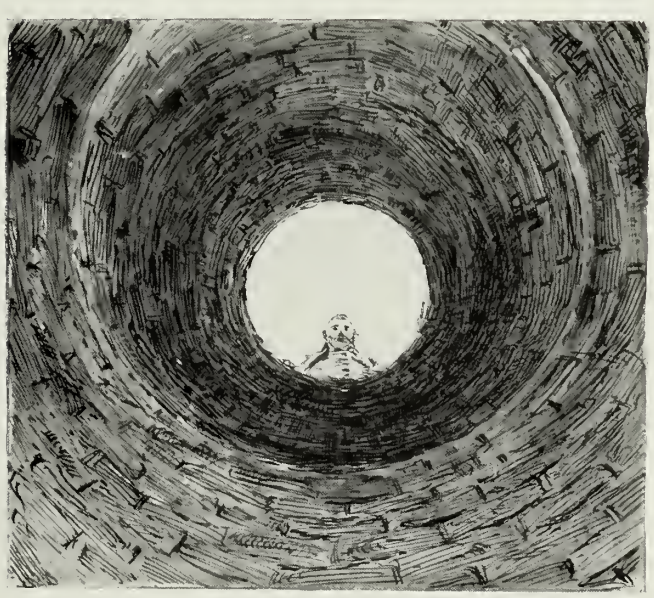
In this drawing I have ruled a line right across the picture to act as horizon to the sloping plane of sand, and have marked it "vanishing-line of sloping sand," because the slope of the shore, if it stretched away to infinity, would appear to end in this line. Now this helps me to make all the men the right size, for all their heads nearly touch the line, even if they are wading, because the slope continues under water.

Beside the vanishing-line I have ruled the horizon where the surface of the water and the sky seem to meet. All water-marks left on the sand by the retreating tide, and also the margin of the water itself, will vanish at the point where these two ruled lines cross each other, because it marks the intersection of the two planes.

I have introduced *Reflections* here. Though often called shadows by unthinking people, they are of a totally different nature. Reflections are only seen in still water, wet mud, polished metal, or glass. These do not take light and shade in the same way as dull surfaces do; they reflect what is around them. It is impossible to throw a shadow upon a looking-glass. If it were very dusty, the dust would take a shadow; it would not be upon the glass. The laws which govern reflections are also quite distinct from those of light and shadow. Here you will notice that the image in the water is exactly under each man, and that the height of the figure above the water is simply repeated on the surface. In the case of the men on the right, you will bear in mind that their feet are above the level of the water, and that allowance must be made for this additional height.

Reflections on sloping surfaces such as the wet sand will not be directly underneath the object, but will be drawn or tend to the side from which the slope falls, which is in this case to the right. This can readily be tested in the case of reflections of chimneys on a wet roof.

I will ask my reader to try to fix in his mind the idea that all flat surfaces, if they were continued on into space, must at last be bounded by the sky, just as the sea is at the horizon. Also that parallel lines on this flat surface must, if they be continued far enough, finally meet in points on the horizon of the surface. Stand underneath some tall tower, and look up. You will find that upright sides vanish in a point exactly over your head. Look down some deep well, and if the water is still, you will see the reflection of your own head. This will be the vanishing-point of all the upright lines in the brickwork of the well. If two or more people look down, each will see the upright lines vanishing towards his own reflection. Every upright object, therefore, vanishes in points. Looking upward, they will run towards the zenith overhead ; looking downward, towards the nadir under your feet. Suppose now that you stand close under some great wall like that of the south front of the Ducal Palace in Venice. Looking east, you would be turned towards the vanishing-point of all the horizontal lines, such as the paving, coping, courses of stone, and moulding. Look upward at



the diagonal patterns of many-coloured stone, and you will see that the chequers vanish towards a point in the sky over the east, 45° above the horizon, whilst the upright pillars and lines of ornament all tend away to a point exactly over your head. If the wall could be continued into infinite space, its horizon would appear as a great semicircle, starting from the east upward to the zenith, then on down to the west. We can call this great semicircle the vanishing-line of the plane, and any parallel lines on the south front of our building must vanish in a point on some part of it.

You must not think of vanishing your upright lines towards the zenith when you paint a picture that is intended to hang on a wall, because the sides of your canvas and all the upright lines in the picture are already conniving towards that point. If you paint on a ceiling it will be quite correct to do so, and if you design a pavement you can draw the upright lines vanishing towards the nadir. One often sees men at the windows of the attic painted smaller than those on the ground floor, or sailors on the royal-yard half the size of those on deck ; but it is not right to draw them so.

Here is a slope of sand. We are looking along shore, and the vanishing-line inclines across the picture, cutting the horizon just where high-water mark and the margin of the sea seem to vanish. I have marked the spot by a lighthouse. To get this view you must be sitting down with your eye 3 feet from the sand. The vanishing-line cuts through the waists of the fisher-folk who are standing erect. The reflections of the men now tend away to the left, as the sand slopes down to the right.

At first sight it might seem that the horizon should cut the stems of all the boats in the same place as it does in the nearest one. It would do so if the world were flat. But we have now reached the stage at which we can deal with the world as it is, *i.e.* round; and if you draw your boats from nature, you will find that they rise higher with regard to the horizon line as they sail away, until at last, when they reach it, the whole hull cuts clear against the sky. After this the boat becomes more and more hidden, until it disappears from sight, whence the nautical term "hull down."

You must not gather from this that the visible horizon should be drawn curved instead of ruled straight. From the top of some tremendous mountain on a very clear day it might be possible to see the slightest possible curve, but it would be so slight that you could hardly represent it in a picture.

If you look down on the same scene from a pier, so that your eye is 10 feet above the sand, the subject will look like this. The vanishing-line still slopes across the horizon, just where the waves and water-marks seem to vanish, but the heads of the men are now 4 feet below it. Of course the men in the boats, not having anything to do with the plane of sand, have nothing to do with the vanishing-line either. I have ruled a dotted line above the sea-line to show both actual and visible horizon.

Looking obliquely out to sea, the vanishing-line of the sloping sand runs across rather less sharply. Here your eye is 4 feet above the sand; so the vanishing-line cuts through just below the shoulders of the fishermen. The waves and water-marks still vanish in the lighthouse, which is, however, a long way to the left, outside of our picture. The wheel-marks and footsteps vanish in a point on the vanishing-line of the plane of sand away to the right.

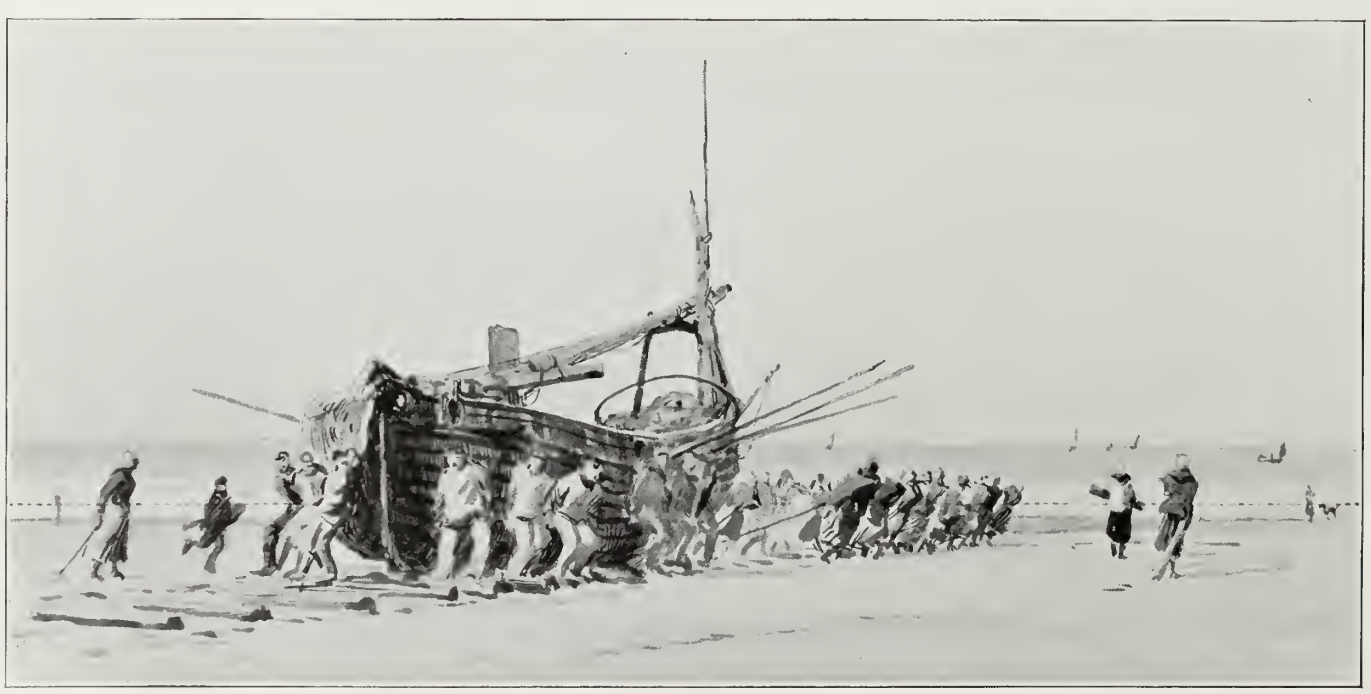
Note the reflections in the water are immediately under the objects, and on the slope of the wet sand they incline to the left.

The rotundity of the earth is again shown by the boats rising as they sail away into the distance.

When you are looking straight down the slope of the sand, the vanishing-line will be drawn under the horizon and parallel to it. The distance between them will vary with the steepness of the slope ; the steeper the slope, the lower its vanishing-line.

A practical way of finding the vanishing-line of any slope, if you are painting from nature, is to plant a long stick in the ground some 20 or 30 feet from you, and to mark on it the height of your eye above the sand. The vanishing-line of the slope will pass through this mark.

In this picture your eye is 6 feet above the sand ; therefore the heads of the fisher-folk are a little under the dotted line which I have ruled across the sea. Note that the wheel-marks and foot-marks vanish in a point on this line. Of course you will put the points in such places as best suit the composition of your picture.



Here is another drawing of the same sort. The artist is sitting down, with his eye on a level with the waists of the people. You will see that the pulling women, the footprints, and the lines of the

greased planks all run to a point on the vanishing-line which I have marked by a dog.

By observing these rules in drawing, your work will become more realistic. It is almost impossible to draw such subjects correctly by merely trying to copy what is before you. Everything is moving: the tide is rising or receding; the sun moves round and alters all your light and shade; the boats sail away, or are left high and dry, far from the waves with their play of reflection and dancing light. If you try to build up your subject on dry land, the result is generally very uninteresting. There is a terrible want of "go" about the attitudes of your figures. Instead of a brilliant contrast of flesh tint against sparkling water and bright sky, everything is earthy and dull. We all know those built-up pictures the moment we see them in an exhibition. You may depend upon it, it is best, when you have chosen a subject from among your rough sketches, to go out, regardless of discomfort from wind, rain, or sun, and to work on the actual spot. If the tide comes up, keep moving back. If the sun moves round, move round too; your rules will keep your drawing from going very far wrong, providing you bear them in mind all the time you are painting. This, by the way, is not so easy to carry out as you would think. It is only after considerable practice that the mind is trained to think of theory and rule just at the same moment that the eye and hand are strained to the utmost, the former searching for truth, and the latter vainly trying to record it.

In nature the slopes seldom run on far at the same angle, so I will show you now how to apply your rules when the slopes vary. Let us suppose that the light dry sand in the foreground is somewhat steeper than the dark wet sand lower down. Your eye is the same height above the sand as those of the fishermen in the foreground; therefore the vanishing-line of the steeper slope will pass through their eyes, and the cart tracks will vanish in points on the line which I have marked by stars. When the tracks reach the less steep slope, they will vanish in points, marked by crosses, in the new vanishing-line just above the breakers. Now if you measure the man on the wet sand carrying a spar, you will find he is two-fifths of the height from his feet to the vanishing-line of his sand; all other figures on the same sand must be two-fifths of the distance from their feet to the same line. By making the very distant figures a little smaller in proportion, you can give the notion that the sand slopes again a little more sharply. When you come to the surface of the sea, it will not be perfectly flat, but a very gentle curve. At 26 feet above the level of the water the visible horizon is five minutes of arc, or one-sixth the apparent diameter of the moon, lower down than the horizon you would have to

draw if you wished to represent correctly in the foreground of your picture any level surfaces, such as paving or the edges of walls.

If you paint from higher up, the difference is much more marked; so that if you look from the top of some tall cliff, you will find quite a considerable curve on the surface of the sea.

This drawing is much the same as the last, but I have introduced sun-shadows on the sea and on the different sloping planes. First there is a rather steep slope of shingle. I was sitting down to draw, so the vanishing-line of this plane passes through the middles of the men standing on it. Next on the gentler slope of wet sand the vanishing-line is more than twice the height of the men. And last there is the comparative level of the sea, with its horizon four times the height of a man. The shadows all vanish to points on their respective vanishing-lines exactly under the sun, which has a bright reflection on the water and on the wet sand. If these were quite smooth like a mirror, there would be a perfect image of the sun instead of a path of shimmering light.

By the way, it is curious how often this path of glitter is painted much narrower in the distance, just as though it were a common high-road which is subject to the laws of perspective. Now the width

of the glitter under the sun depends on the position of the sun itself; it is wide when the sun is high, and narrows as it sinks lower. It also varies a little with the amount of ripple on the water. If by chance you see one part of the shining sea narrower than another, it is at a place where the waves are less steep, and the water calmer. Mere distance never narrows it.

If you want to give an appearance of strong current to a river, you can do so by making the banks, and the objects floating on its surface, vanish in points above or below the horizon, according as we are looking up or down stream. This picture represents a river rushing out of a lake. I have made the banks and boat vanish in a point to the left, where I have stationed a native.

Here we are looking down stream. Accordingly I have drawn the banks and boats running down to points below the horizon. The lower these points, the swifter the river will seem to run.

We are as yet only on the threshold of the subject, which becomes more complicated as we go on.

It is not difficult to stand beside a pupil, and show him how the lines and planes he is trying so hard to copy ought to run. He looks up, and sees that what you say is the truth. Nature herself is there in corroboration. Having made him see and believe, you can go on to the why and wherefore, and a diagram on the corner of his

drawing makes the whole thing clear to him in a moment. Writing on the subject is very different. I wonder to myself, Now is that put in such a way that people will understand? or, Will the reader shut up the book in disgust? A certain amount of imagination is required to picture these invisible planes stretching away to infinity. The mark left on the sand by the sea after a

high tide is a good example of a plane of this sort, only visible just where it intersects the slope of the sand. You may often find, when you draw from nature, that these water-marks twist and zigzag about like the contour lines on a military map. It would be far too much trouble to find vanishing-points for all the little short lengths of tide-mark. You will bear in mind, however, that these lines of stranded seaweed are quite level, even if they do twist a bit. Therefore any figures you may introduce into your picture standing upon them must follow the same rules as they would were they standing on a plane. Now the man in the foreground standing at high-water mark is as high as one-third of the distance from the sand at his feet to the horizon; therefore any other figures you may wish to put standing on the same line must also be one-third. The woman on the second water-mark is nearly one-quarter as high as the distance from the sand at her feet to the horizon; so all the other women along this tide-mark must be the same size in proportion to the height to the horizon, which I have supposed to be a little higher up than the visible line of distant sea, which you will notice cuts the masts of the boats lower down, the farther they are away.

This is the same kind of scene, but viewed

from lower ground. Here the horizon cuts through the waists of the men on the high-water

mark, and is over the heads of the men on the edge of the river. Here I have allowed very little for the curve of the world, as the sketch is taken from so low down.

This is a drawing of a road running downhill. The sun is on our right hand, and the shadows are thrown across the picture. I have ruled a line for the vanishing-plane, and you will notice that the wheel-marks vanish to different points on it. It passes through the shoulders of the men. By the drawing of the shadow of a tree trunk we can give a notion of the ground it falls on. It runs sharply down the bank the tree grows on, is much broken by the ruts on the road, and then rises as it mounts the tufts of grass on the other side of the road. Thus shadows may be very eloquent, and by curving up or down may represent a convex or concave rounded surface.

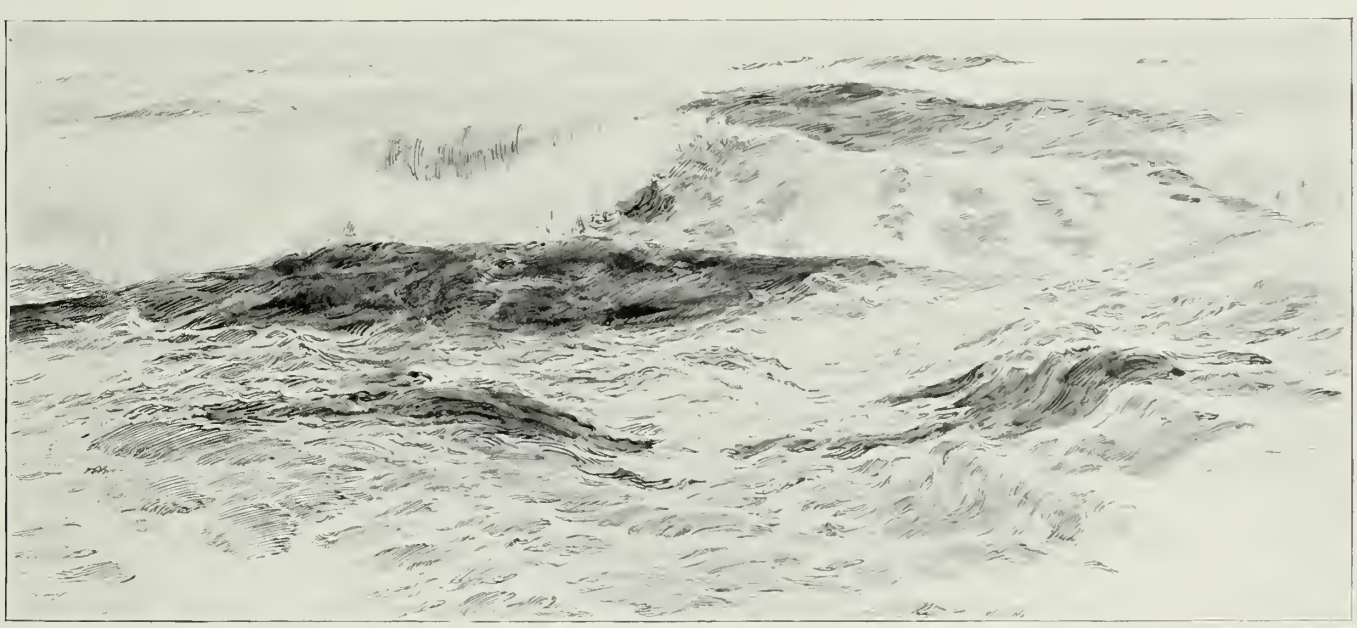
The same road, looking uphill. You will notice that the wheel-marks all vanish in different points on the vanishing-line of the plane.

Many people will say that the rules of perspective are not wanted when you are dealing with open country which slopes up hill and down dale at all sorts of angles. But I think that the following drawing will show that they will help to give realism to even a very slight sketch. There is always a certain charm about a drawing which appears to be done easily—where the touches are put on without hesitation, and are left to give what impressions they may of the original scene. Now there are many ways in which perspective will help you to convey with only a few lines a notion of a scene which will tell more than misdirected elaboration of the most painful kind.

I have here sketched a meadow sloping gently downhill. In the foreground is the shadow of a house; near the middle of it is a × marked V.P.S.R. The sun's rays vanish in this cross, and the shadows of upright objects such as the flagstaff, the chimney, and the trunks of the trees vanish away to a point over it, not *on* the horizon, but a little below it, where the vanishing-line of the slope is to be found. There is a rise on the left, as we may see from the hedgerows running away uphill, and the vanishing-line of this plane crosses the horizon near the middle of the sketch, so that the shadows of the two distant elms on the left run to a point higher up. Thus, by moving the vanishing-points a little, we can suggest any kind of slope we wish.

Here we have the shadow of another house. V.P.S.R. is much higher up; therefore we know that the sun is near its setting.

The long shadows run towards a white house in the distance; it must therefore be on the vanishing-line of the sloping part of our meadow. But there is a second slope away to the right, for the shadows of the distant trees on that side are vanishing to points much higher up than the white house. Thus a rounded shape is given to the hill.



When you are trying to represent curved surfaces, you will often find the correct perspective of any pattern or marking on the surface will help you to produce the effect you desire. The design woven on a dress, or the blazon on a flag, can be thus used.

In this picture I have utilised the spume on the surface of the waves to model their shapes. You will see at once how by foreshortening the markings you give a notion of heave and swell to the water. Where the foam is much foreshortened the slope seems gentle; and by drawing the pattern as though it were a map, you can make a wave stand up steep.

When the wind blows in straight lines, they vanish in points as other straight lines do. In this drawing I have supposed that what sailors call the "wind's eye," *i.e.* the point of the compass from which the wind is blowing, is behind the lightship with the ball on its mast. You will notice that the smoke is shown as though blowing to the right of vessels to the right of the line between you and the lightship, and to the left of vessels to the left of this line. Compare with this what was said about the sun-shadows in the first part of this book. The crests of the waves are at right angles to the wind, so in this case they may be drawn straight across. If the sailing craft were all close-hauled, and all sailing equally close to the wind, they would tend to vanish, those on the port tack in a point on the right side of the picture, those on the starboard in a point on the left side of the picture, each point equally distant from the wind's eye.

In these six drawings I will suppose that we make a half-turn to the right at each new picture: thus there is a north wind, and in the first drawing we are looking north; then we turn to the north-east for the next sketch, then to the east, to the south-east, and to the south for the sketch in which the kites are flying, looking at last south-west for the sixth picture.

We are now looking to the right of the last subject ; in fact, the two drawings might be joined side to side. Here you see the vanishing-point of the port tack is near the middle of the sketch, and the barges are all sailing towards it. To represent some of the craft sailing nearer the wind than others, I have made them point more to the left. The vessels on the starboard tack now appear broadside on, sailing to the north-west.

In this picture the vanishing-point of the port tack is on the left ; and the vanishing-point of the waves, which are at right angles to the direction of the wind, is on the right. In these drawings I have drawn the light upper clouds vanishing towards the wind's eye, just to give an idea of the wind's direction. This is not always the case in nature. Often the real clouds twist about, and therefore run to several different vanishing-points ; but, as I will show you later, these points are always a good bit below the horizon which bounds our view on earth.

Once more turn, and we have the point from which the vessels on the starboard tack are sailing right in the middle of the picture. Here let me impress upon you that all these vanishing-points are not hard-and-fast minute dots, as they would be if we were dealing with absolutely straight lines. Even when the wind is most steady, there will be little puffs which come from the right or left. The wave crests will not all be exactly parallel. And even if they were, the surface of the ocean being part of a great sphere, the vanishing lines on the horizon would be some distance apart.

All boats do not steer exactly the same course; some skippers keep their craft nearer the wind than others; but for all that you will find, if you try to draw any fleet of boats from nature, that the knowledge of these rules will help you to draw them much more correctly than would be possible from merely looking at the moving vessels and then trying to put down what you saw. You will certainly be saved from all the more grotesque errors incidental to this last method.

Looking to leeward, that is to say, towards the point your hat would fly to if it were blown off, you will have the vanishing-point of the wind somewhere near the middle of your subject. I have marked the spot with a windmill. The two points from which the vessels on the port and starboard tacks are sailing would be outside the picture to the right and left. Instead of lying over towards you, the craft will now list away. In fact, if you suppose them to heel very much, you might quite well take a spot up in the sky for all the masts of the vessels on the port tack to vanish to, and another away to the left for all those of vessels on the starboard tack.

The cross-trees and beams would tend also towards two more points under the first ones, and near the bottom of the picture. However, all these points would be so far outside the limits of our sketch, that it will be quite sufficient if, when you look to leeward, you draw your boats with their masts leaning slightly towards each other, and when you look to windward, leaning slightly from each other. By the way, the strings that hold the boys' kites would vanish too, though you could not fix on one point for them to run to, because they belly to the wind, so that the farther part of the curve vanishes higher up than the nearer end.

I drew this subject exactly as I saw it in nature. It shows the vanishing-point of the wind away in the left-hand corner. I have marked the place with a windmill. You will notice that the hulls of the boats, which I suppose were head to wind, vanish towards it.

Nature has in her great storehouse an endless supply of truths. Those who study her are always finding new ones, and there are plenty more where those came from—yes, and more again. There are old truths too, truths that were discovered by the great masters of the past, and some of them seem to have been forgotten again since. All of them will help you to construct your pictures, if you have the wit to use them rightly.

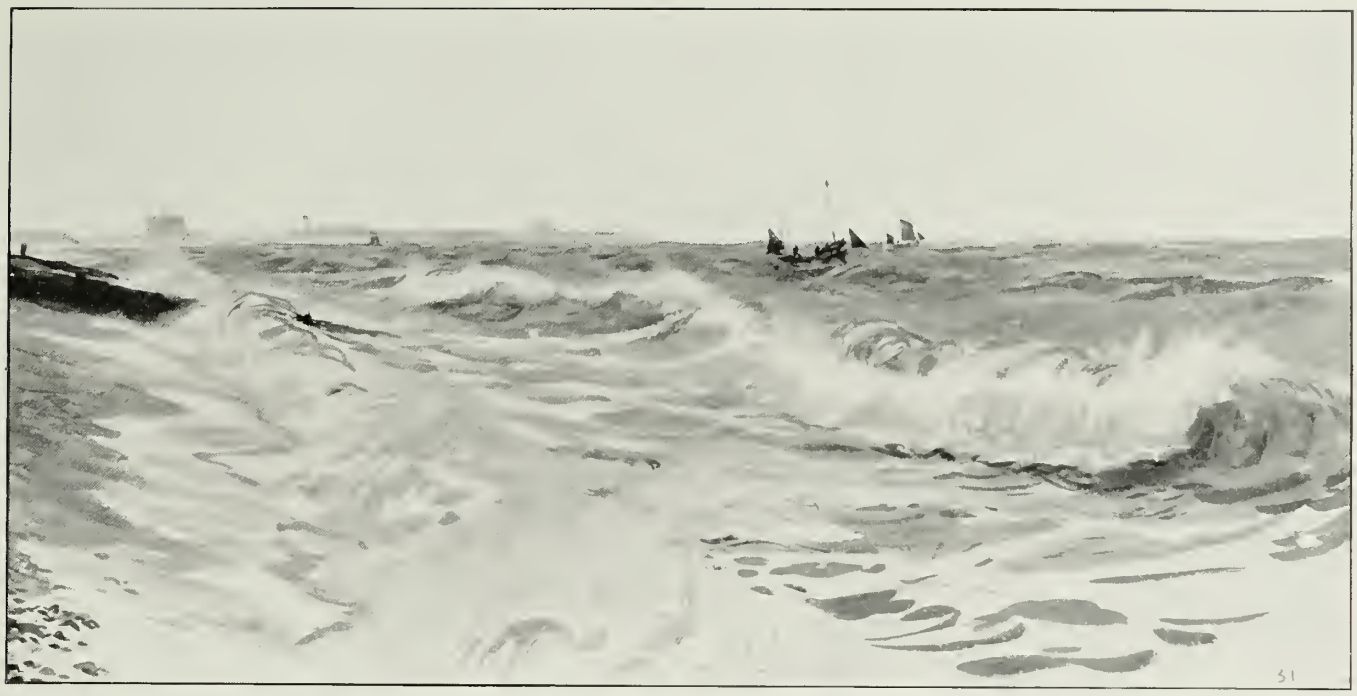
We have turned nearly three-quarters of the way round, and now look towards the point from which vessels on the port tack would sail. On the right is the vanishing-point of the crests of the ripples, and on the left, about an inch outside the picture, is the vanishing-point of the wind, towards which the light upper clouds and the smoke from the chimneys on shore are blowing.

Here again I may point out an advantage we gain from our rules. Correctly applied, they enable us to indicate the relative speed of vessels, for the flags and smoke of moving craft have vanishing-points of their own, varying in direction according to their speed. If you watch one steamer passing another, you will see a marked instance of this.

When there is much wind, birds always soar and hover with their heads turned towards it. Water-birds also swim to windward when it blows, and even stand facing the breeze, except in sheltered spots. Of course you will not paint them with their heads all exactly the same way, although they generally are so, and when they alight, they always turn towards the wind.

This drawing was made in the Suez Canal. It shows the two parallel banks vanishing, not on the horizon, but in a point somewhere near the top of the funnel of the distant steamer. It is only the

very farthest part of the margin which vanishes towards the horizon. This is an illustration of the way the curve of the earth asserts itself the moment you begin to draw from nature.



Here is another sketch made by the sea, and you will notice how the parallel lines of the waves vanish up somewhere near the top of the Martello tower on the left. This is again because we are dealing with a curved surface, and not a plane.

Here is another coast scene. It was not drawn specially for this book, or to demonstrate any theory ; but it shows the curve just as the last two have done.

The roundness is much more apparent in a sketch which only embraces a small section of the horizon than in one which takes in a wide angle, so that you have to turn your head when looking from one end to the other end of your subject. That is to say, a narrow-angle picture shows up the curve more.

I have shown that the surface of the sea is always convex, and that any parallel lines upon its surface must vanish in points above the visible horizon. When we try to paint a sky, however, we at once find that the surfaces we are dealing with are concave.

When poets sing of "heaven's vault" or of the "dome of air," they are only stating actual facts; and when you try to render on your canvas the forms of the dappled cirrus, and the long lines of mare's-tail or mackerel sky, you will find the task more easy if you bear in mind that you are looking up at the under side of a great vault.

On some days you may see long streamers of fleecy clouds stretching right across the sky from east to west. If you study these carefully, you will find that they vanish in points, and that these points are always a long way below the horizon.

In this and the succeeding drawings I have tried to show the appearance of the two curved surfaces—the cup-shaped cloud over the gently rounded sea.

Of course the curve is much more easily seen low down near the horizon, and you will notice it much more when the weather is clear. Even in foggy England, however, you may often see such a little cluster of ribbed cirrus as I have drawn here ; and if you try to follow the twists, you will find that the ridges tend to meet in points a long way beyond the sea-line. The farther the clouds are away, the lower will be the vanishing-points.

In the tropics, where the air is clear and transparent, the dappled sky has a palpable hollow in its under surface, and the setting sun lights this up with crimson and gold in a way that would be quite impossible if it were a flat surface.

You will often notice that the very distant strata away in the far west are lighted on their *upper* edges, while at the same moment the nearer layers are illuminated underneath. Then the gradations of colour, from yellow in the west, to orange and purple, and at last to ashy gray in the extreme east, will show again the shape of the giant dome overhead.

Here is another instance of the lines of cloud vanishing away to points below the horizon The wind is blowing from behind the steamer on the right, so the vanishing-point of the crests of the waves is a very long way to the left, as they are at right angles to the direction of the wind. The vanishing-point of the vessels on the starboard tack is about two inches to the left of the picture.

In this illustration I have tried to show two surfaces of cloud, and underneath, first a slope of wet shining sand, and then the rounded surface of the sea. The light upper layer of mottled cirrus shows a gently curving under surface, and the lines of dapple vanish away towards points low down on the far right, and nearer in on the left of the drawing. Under this is a bank of fluffy nimbus of all shapes. You will notice that as these woolly clouds stretch away into the distance they get more and more behind the horizon, peeping up half hidden, and at last disappearing behind the sea altogether. Then take the wet sand : it slopes away towards the sea ; its vanishing-line is somewhere about the hull of the nearest boat, for you notice that the sails of the distant craft are reflected in its surface. This would not be the case if the sand were level, for then the reflection would only be the usual length, viz. the length of the mast repeated underneath.

When wading figures are introduced into pictures, it is quite a common thing to see them painted with the surface of the water cutting them at various heights, as though some of them were standing in holes in the sand. It is true that in nature the water deepens suddenly at times, but in this case the character and form of the water change too. Here I have supposed the eye of the artist to be as high above the sloping sand as the shoulder-blades of the bathers; therefore the vanishing-line of that plane cuts through all the figures at that same part. So far all is easy; but when we come to guess how far up the water cuts them, mistakes may easily be made. For instance, take a pencil and continue downwards the figure of the man on the right, so that the water cuts his knees; you will see at once how very wrong he looks.

A simple way to make your figures look correct is as follows:—Mark the position of the heel of your man; from the margin of the sea rule a line through the heel to some point on the vanishing-line of the plane. Exactly over this point make a dot on the horizon, and from this dot rule a line back to join the first line on the margin of the sea. This will cut the figure at his correct water-line.

By the way, you must rub out the heels of your figures when you have finished using them to measure with, for in nature you will never see the submerged part in the same correct proportion as the half that is out of water. The refraction of the transparent sea always flattens objects seen beneath the surface. Very few artists are bold enough to copy what they see in nature when they paint people in the water, though the refracted part of the form looks very well when it is properly done. (See Millais's "Ophelia.")

When the surface of water is perfectly smooth, the reflections of upright objects are seen directly underneath them, and of just the same size as the original. The vanishing-lines of the real objects, when they are horizontal, are repeated in the image, so that the lines of the reality and the lines of its reflection vanish in the same points. When the object throwing the reflection is slanting, like the bowsprit or the main boom in the drawing, you can drop perpendiculars, making the part below equal to the part above. If you prefer, you can do as I have done in the case of the roof beyond. Take a vanishing-point for the reflection as far below the horizon as that of the real object is above it. All the vertical lines of the building are simply repeated beneath.

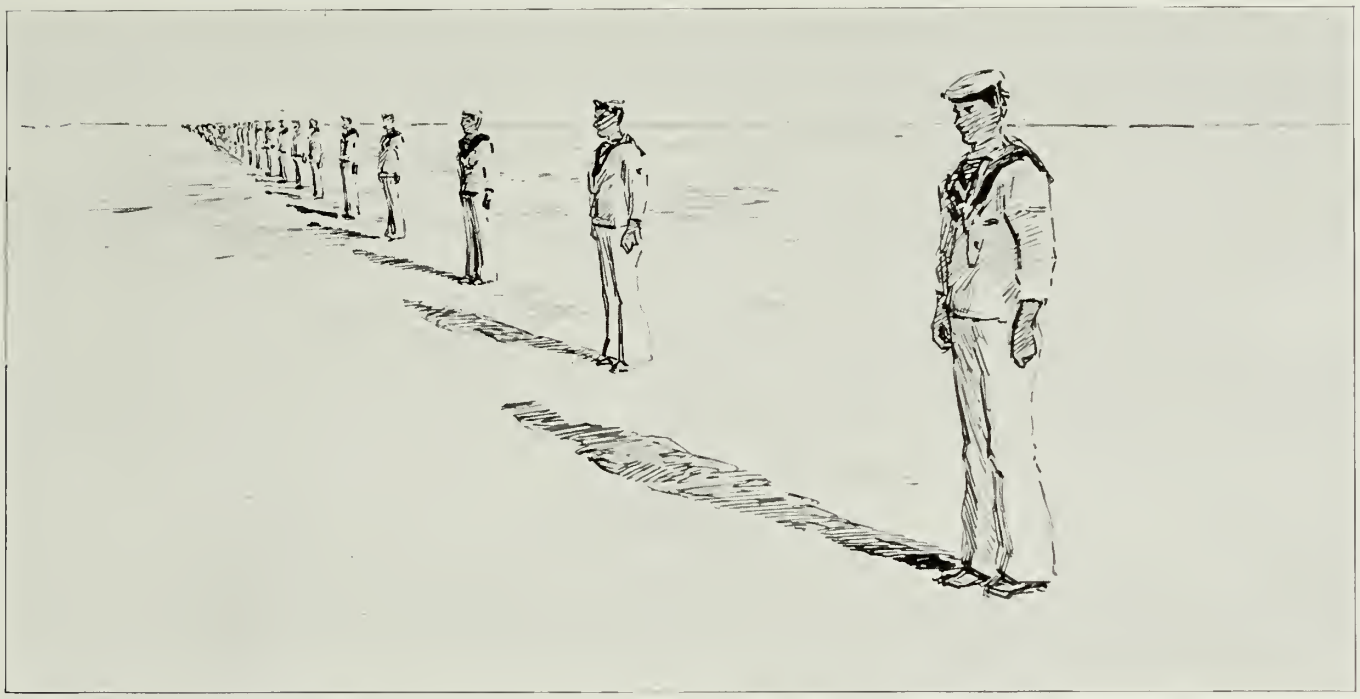
When we come to reflections in sloping surfaces, matters are different. According to the direction of the slope, the reflection will be turned to the right or to the left, lengthened or shortened. To be correct, you must drop lines from the corners of your object at right angles to the slope, and then repeat them. The reflections of the chimneys in the wet roofs are instances of this.

Supposing the water to be gently heaving, you will find the reflection to be cut up into a number of zigzags, as the slope of the surface pulls the image to the right or the left. In the drawing of the fishing-boats, I have supposed the swell to be rolling towards you with alternate concave and convex curves. The result is that the image is not only first lengthened and then shortened, but

some parts are reflected upside down, and others the right way up, in the same way that you can see your face in the concave front or in the convex back of a spoon.

If you study rippled water, you will find an infinite variety of curves and twists, which sometimes pull the image into very graceful lines. This is especially the case when the waves are not so steep as to break up the image too much.

When the face of the water is ruffled by wind, the reflecting surfaces are so much cut up, and lie at so many different angles, that it is quite impossible to trace any shape in the reflection. You will only find certain parts of the water darker where the innumerable little slopes catch each its tiny reflection of the object overhead. As a rule, in this case the colour depends on the hue of the water, not the object.



If two or more men of equal size stand at different distances from you, they will appear larger or smaller in exact proportion as they are far or near. For instance, the man in the middle of this picture is twice as far off as the man on the right; therefore he is half his height. The third man is three times the distance, and therefore one-third the height, and so on as far as the eye can see.

Now the nearest man may be 10 yards from you, and the next man 20; or they may be 50 and 100 yards respectively: the rule holds good just the same.

There is a very curious property about this drawing. The men look nearer or farther in proportion as you hold the picture near to or farther from your eye. Hold it an inch from your face, and the sailors seem to be standing 8 or 9 feet apart. Now hold it at arm's length, and they will look more than 20 feet apart. Put the picture on the mantelpiece, and look at it across the room, and they will seem a long way from you and from each other.

It is most important that artists should understand how different are the effects their work may produce according as it is seen from near or far off. All the alterations of distance you can observe in this little sketch will be much more marked in a large picture, where, owing to the colour and light and shade, there will be a certain amount of illusion. Very often an artist begins to alter a picture which is perfectly right from one point of view, just because he has happened to catch sight of it from another distance. It is quite possible to paint a subject that will be correct in drawing and look fairly right from different points of view, but you must be careful to draw most of your objects in profile. If you paint a figure, you must not make one foot nearer than the other. The moment you introduce into your picture any fixed distance foreshortened, or any object with lines at right angles in it, such as a box or a house, you fix the distance-

point—that is to say, the distance from which the picture must be viewed in order that it may look right.

Very few modern artists seem to understand the importance of this simple rule. Having chosen a wide angle for their subject, they give themselves endless trouble, cutting down the sizes of objects in the foreground, and making the whole picture look wrong, just because they happen to have caught sight of the work from a little distance.

This and the following drawing show how a picture differs according as it is painted from close to the subject or from far off—in other words, with a short or a long distance-point. Each of them can be made to look correct, if you only hold it the right distance from your eye.

This picture was drawn from close under the bows of the ship. You will notice that the bowsprit is very large, and the mizen mast very small, and that the white bands and lines of the ports taper very rapidly towards the after end of the two-decker. Consequently, seen from a little way off, the whole looks out of proportion and distorted. In spite of this, however, our battle-ship has an air of importance, not to say grandeur; and if you look at the drawing from about three inches distance, the twisted appearance goes away altogether.

This shows the ship as she would look if you drew her through a telescope from some miles away. Here, though the direction is the same as in the last plate, everything is as though it were drawn to one scale ; each spar is in exact proportion ; the men at the fore end of the ship are just the same size as those at the after end ; the ports and the stripes are the same width all along. Now such a picture might delight a sailor, but it is, nevertheless, rather uninteresting. It only looks correct when held more than six feet from the eye ; and it is no more exciting than a rigging plan from a shipbuilder's drawing office.

These two pictures touch the two extremes. But you will understand that between the very wide-angle picture and the very narrow you have a great range of distances, all of which can be used for different pictures. The main considerations are : first, the place in which your work is likely to be seen ; second, the effect you wish to produce, or the story you have to tell. Bustle and animation will be best shown in a crowded wide-angle picture ; so also will great size and grandeur ; but it will be at the expense of correct proportion when the work is seen a little way off. The narrow-angle picture is suitable for simple subjects, broad in treatment, and meant to be looked at from a good way off, such as a poster to be seen across a street, or the decoration for a large hall. An altar-piece should only embrace a very small angle, so that it may look well from the body of the church.

In the next four drawings I have tried to show how a figure subject is altered by the choice of a long or short point of view. First we have a very wide-angle picture. You will notice the left foot of the nearest man is very much larger than the right. Though the figures are all fairly close together, yet there is a great difference in the size of them. The shadows in the foreground are more like maps than markings on a foreshortened plane. Observe also that the roof and sides of the little house vanish in points only a short way outside the edges of the sketch. All these are the clear and evident signs of a short distance-point picture. The nearest man, indeed, is but eight feet from you. The effect on the mind of the spectator is that he feels that the scene is being enacted quite close to him. For that very reason this point of view is always impressive, if the subject be well portrayed, though the great size of the objects in the foreground will cause the picture to look very wrong when it is seen from a little way off. However, if painted very large, and hung in such a position that it can only be seen at short range, such a subject might pass.

In this drawing we have the same five men in exactly the same positions, but as seen from a point farther away. Now when you look at him you no longer feel as though you could stretch out your hand and touch the nearest man on the shoulder. The shadows on the ground are still rather like maps, and there is a good deal of difference in the relative size of the figures. The house is now much larger in proportion, but the vanishing-points of the roof and the sides are still rather too close in; it will only look right at a distance of about six inches. Clearly, then, it will be better for most purposes to choose a longer distance-point.

On the next page our point of view is much farther away, and the effect on the picture is to make the figures more of one size. The house is now much larger, and the two vanishing-points are a long way apart; hence the drawing no longer looks distorted when you see it a little way off. At the same time you will notice that the subject begins to look rather more tame and uninteresting. This cannot be avoided; the longer the distance-point, the more tame the composition will become.

The same subject, but from a still greater distance. Although the men are standing at precisely the same distance from each other as in the first of this series, there is now very little difference in the sizes of them. It now becomes a very unexciting affair, and to counteract this tendency you must put more swing and action into your picture the narrower the angle becomes. Actors have, when they play to a very large house, to exaggerate the movement and make up for the same reason, viz. the distance at which they are seen.

I think I may give an idea of wide and narrow angles by introducing here some of the works of the old masters. First, the wonderful short-distance portrait by Van Eyck. This picture must have been painted long before the rules of perspective were formulated; none

of the lines vanish exactly to any point, and yet, looked at from the right distance, it is quite a marvel how very nearly correct it is. Fancy what an eye the man must have had, to have worked out all those proportions without any rules to guide him ; yet look how lovingly it is all carried through, even to the reflection in the mirror. The relative size of every little object seems to have been noted, down to the least fraction : even the clogs in the corner are painted different sizes, just because one of them happens to be a trifle nearer than the other. The tiny dog it seems to me would not stay in the foreground whilst the artist worked, and was drawn from farther away. Had he really been as near as he is painted, you would look down more upon his back. I expect, too, that he would have looked a little larger, placed as he is right in the foregound of such a short distance-point picture, and that when Van Eyck came to paint him he had not pluck enough to draw him the right size, but cooked things a bit, just as countless painters since his day have done, whenever they painted foreground objects in wide-angle pictures. There can be no doubt that this work must have been painted in a small room, and that Van Eyck went right ahead, and simply tried to paint everything just as he saw it. Moreover, the beauty of the handling and the delicacy of the finish would lead people to go close up when they looked at it. Then a family portrait would very likely hang in an ordinary room, where it could never be seen from very far off, and thus would always look its best.

The splendid portrait group on the opposite page is a complete contrast in every way to the Van Eyck. Standing close to it, one feels just as though we were watching the dissection through a telescope from a distance. I fancy that Rembrandt must have painted it to hang in some large hall where the greater part of the people saw it from a long way off. You will notice that the heads of all the students are very nearly the same size, though there is evidently a considerable space between them. The dead man in the centre of the composition is all to one scale, and though his feet are much nearer to you than his head, yet they are only a very little larger than they would have been, had he been drawn in profile. The result is that, when you are too close to the picture, the body and legs look very much too short, and you wonder if the students have been cut out of card, there seems so little room between them. If you slowly step back from the work, the dead man seems to draw out longer and longer the farther you get away, and there is at last plenty of room for the learned doctors to stand without crowding. Though very highly finished, the "Anatomy Lesson" has a longer distance-point than any other picture I know.

Here again is a wide-angle, short distance-point picture, for the most part faithfully carried through. The relative sizes of the heads, the foreshortening of the book, and the money almost close enough

for you to stretch out your hand and pick up, the candlestick and piles of deeds, are all in keeping. One wonders that the artist, after taking pains to draw all these objects so correctly, should have introduced the ornamental door-head on the right, so evidently painted from quite another position. The distance-point of the mouldings here must be much farther away than that of the rest of the picture.

The pavement in this fine composition of Tintoretto's is evidently worked out by rule, and one might almost fancy that the master may have made use of it in planning the arrangement of all these figures, for it shows through the thin paint in many places, as though it had been one of the first things to be drawn. Notice how carefully the scale of everything is made to suit the short distance-point chosen. Also that the vivacity of the action is in a measure owing to the wide angle subtended by the subject. How absolutely different is the effect produced on the mind by the two pictures which follow.

When so many pictures were painted to hang in churches, I have no doubt that certain traditions were handed down from master to pupil, as to the use of perspective. A great many of the old masters were very clever in the means they used to make their pictures look correct from both far and near. This they did partly by keeping the principal group all to one scale, so that the work looked correct even when seen right across the church, and also partly by avoiding foreshortened objects, which might make it seem wrong when seen quite close.

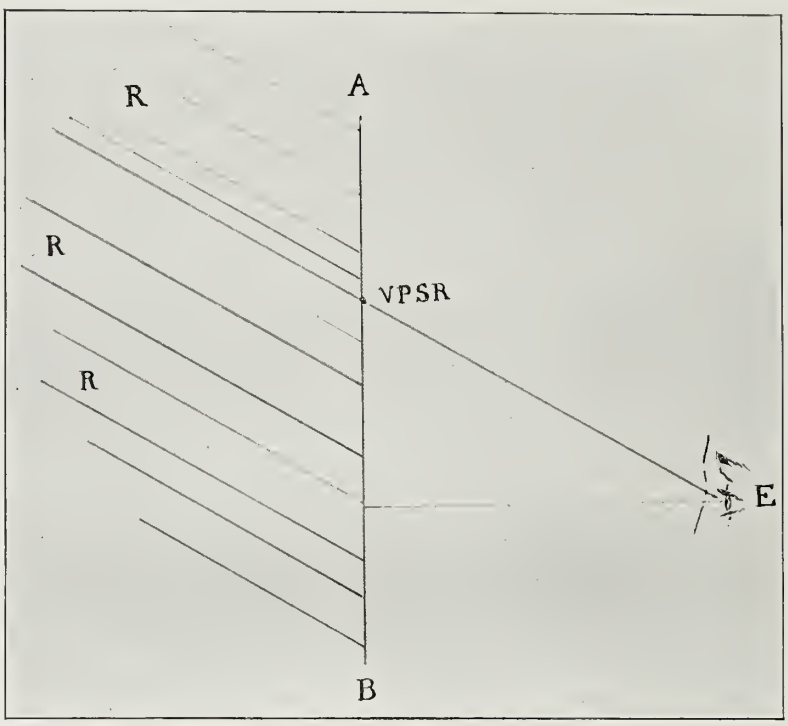
Notice how careful Raphael has been here to avoid anything which might fix the distance. The angel with the flowers and the girl with her hands crossed may be ten feet away or they might be twenty feet, according as you stand near or far from the picture. The one exception is the pattern on the floor, which certainly does suggest a rather wider angle than one would expect from the grouping of the figures. I think the master may have felt this, and painted the markings rather faint, so that they should not be noticed from far off, but only be seen when the spectator was close to the picture.

Here is another picture in which the artist has been very careful to avoid anything which should make his work look wrong when seen from too far or too near. You will notice how carefully every foot is hidden; there are no rows of beams one behind the other, or right angles foreshortened; no moon or sun to fix the number of degrees the subject subtends. In fact, you cannot say that the picture looks better from any one point than from another.

Here again is a composition in which the artist has been dodgy in avoiding anything which might look out of drawing when the picture is seen from too far or too near. It is quite curious to notice how carefully Rubens has avoided fixing the distance-point. Of course we see that the group of Sabines on the grand stand are farther away than the fat ladies in the front, but there is nothing to show how far ; and the foreshortened horse, which might be expected to show us, has his head cut down small and his hind feet made so indistinct that it would be quite impossible for any one to say how far off he is. Even the architecture seems to have been painted in a soft, friable, drop-scene manner, so that we should not know its distance. The planting of one foot on the ground nearer than the other is most carefully avoided throughout. Perhaps you will say, Why not construct all works of art in such a way that the distance at which they are seen will not affect them? A great deal can no doubt be done in this way, but just think how many scenes would have to be left unattempted. You must never introduce a pattern or any foreshortened surface, such as a carpet, or a wall-paper, or buildings with any equal spaces or ornament upon them, unless, indeed, you draw them in profile like a builder's plan. All figures except those in the distance must stand or kneel in profile, or, if turned any other way, their feet must be hidden from view. All ships and boats, carts, horses, dogs, and cattle must be broad-side on, unless they are a long way off. Of course anything with corners forming right angles, such as a box or table, must either stand square or be left out. I fancy the Greek and Roman painters were limited in their treatment of subjects by those very same ideas, for they seldom foreshortened anything in their designs.

On the whole, perhaps it is better to be confined to one sort of treatment than to produce a work, half of which is painted from one point of view and half from another, and which therefore never looks right from either.

I now propose to go on to the geometrical part of our subject. I have put this off to the last, because I know how difficult it is to induce a painter to take any interest in accurate measurements, angles, ruled lines, or indeed in any exact methods. The great bulk of artists simply train eye and hand, only trusting to rough sketches and luck when they attempt to depict any rapidly moving scene. Perhaps it is not wonderful that they should. All their lives they have been observing carefully and transferring with infinite pains what is before them. They know how wonderfully perfect both eye and hand can become, and therefore mistrust any mechanical aid. I would point out, however, that when the mind has been trained to theorise and reason out the problems of vanishing planes and sloping surfaces, the eye is trained at the same time, and is much more keen to observe, noting many truths which before were quite hidden.



If you stand before a window and look out at a number of parallel lines, such as rays of sunlight, courses of brick, or edges of straight pavement, you will find that the lines look shorter the more they are seen end on ; and when at last you look at a line that is so completely foreshortened that it appears only a dot, you will see that this is the vanishing-point of all the other parallel lines.

Here is a diagram. *AB* is the glass of the window, and the sloping lines *RRR* represent rays of sunlight. To the eye of a spectator at *E* the rays will appear to vanish in the point *V.P.S.R.*, which is exactly between his eye and the sun. If you wish to represent on the window-pane the exact appearance of the lines as seen from *E*, you have only to draw them to *V.P.S.R.*, and they will be correct. If the sun is at an altitude of 40°, the point on the glass can be found by drawing a line from the eye which makes an angle of 40° with a line drawn to the horizon.

It is very important that you should fix in your mind clearly that all parallel lines appear to vanish in a point in the far distance, and that, furthermore, this point may be represented on a transparent plane, such as the glass in a window, by simply marking a dot on the glass exactly between your eye and the point, like this •

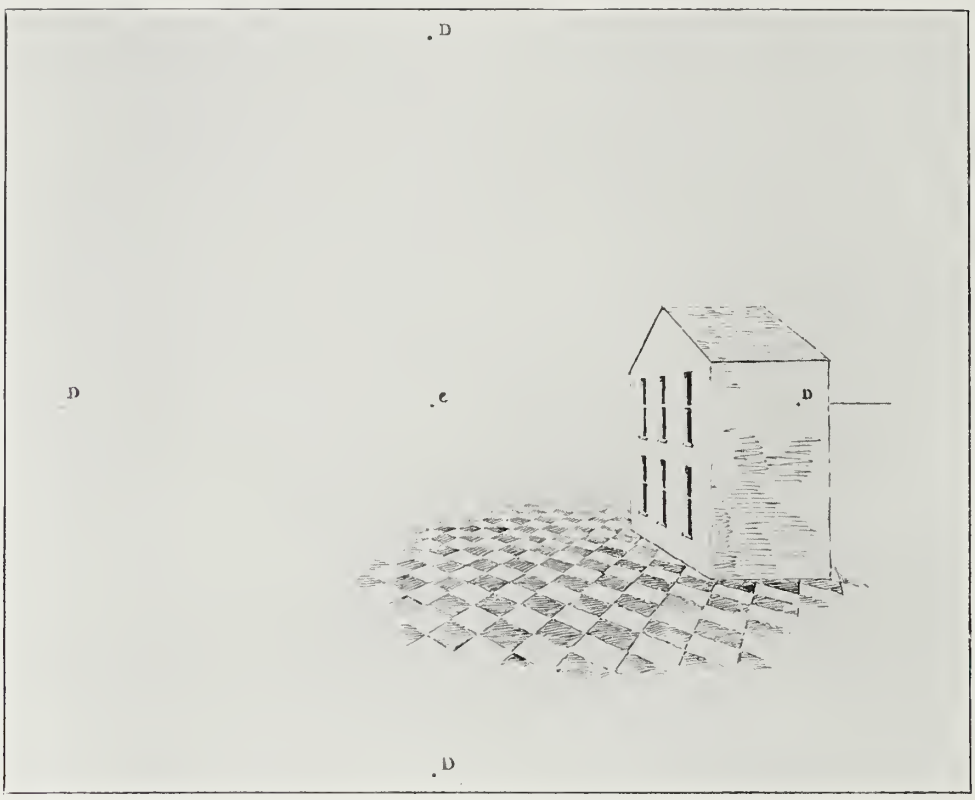
By the way, glass windows in real life slightly bend those rays which pass through them at an angle, so we ought to make a small allowance for refraction if we wish to carry these window-pane pictures out exactly. It is hardly worth while troubling about them, though, for it is only in the extreme corners of the pictures that it would be noticeable.

As there is a good deal of confusion in the minds of artists as to the true principles of the science of perspective, I have tried in the next diagram to show what is meant by projecting objects on to a plane.

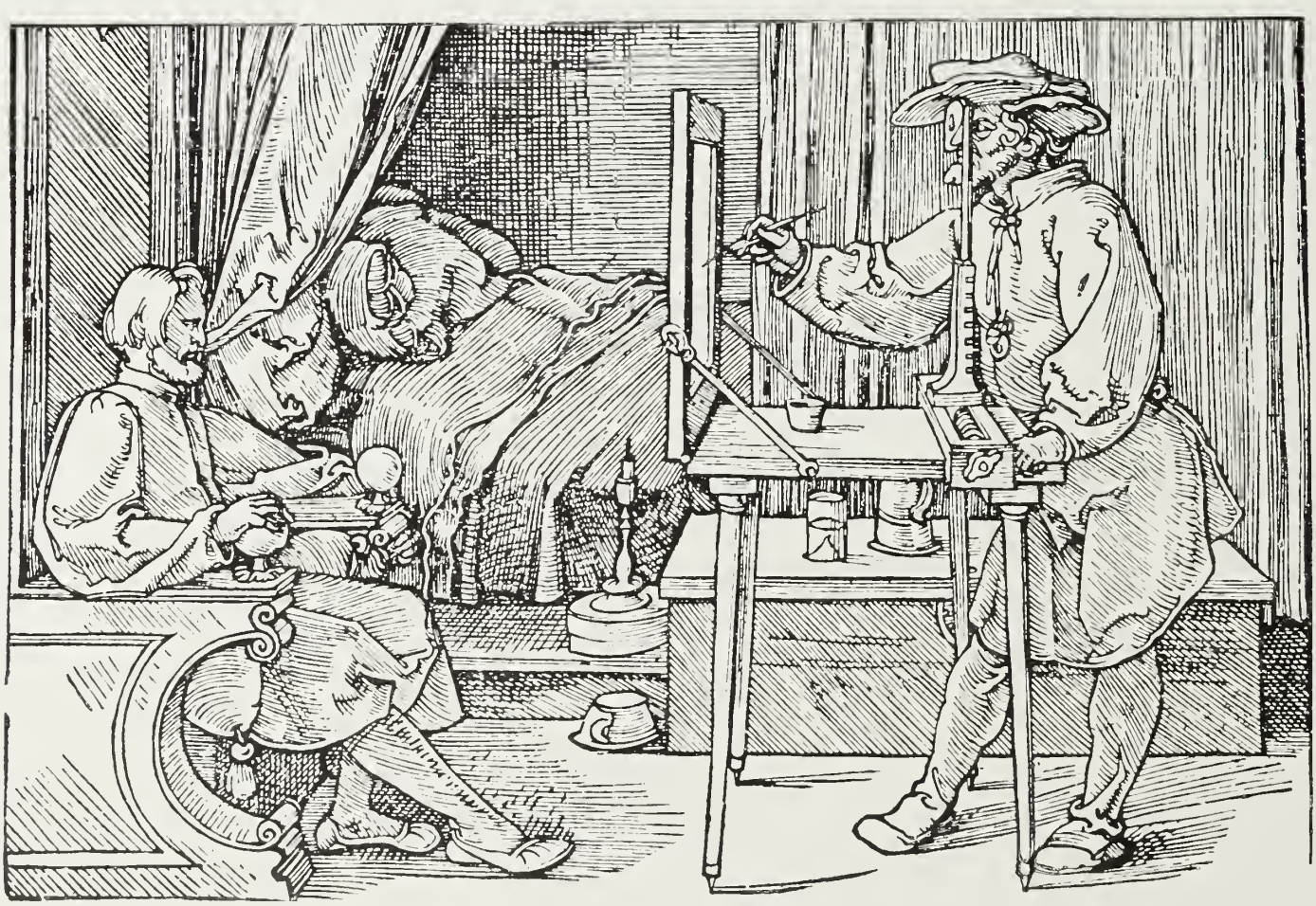
Here is a man drawing on a window-pane the objects outside. He need not know any rules to do this. The only important thing for him to remember is to keep his head quite still, and to shut one eye. If he draws round the outline of everything he sees outside, he will make a perfectly correct picture of the subject, which will look right when it is viewed from the proper distance.

Now, on the pane of glass there must be one point which is nearer to the man's eye than any other part of the surface. We will put a dot on this point, and call it *C*, the centre; it is the vanishing-point of all lines at right angles to the sheet of glass. We will call the glass the plane of our picture. If the distance from the man's eye to *C*, the centre, is laid down along the surface of the glass, it will give us the distance-point *D*, which is also the vanishing-point of all lines at an angle of 45° to the plane of the picture. The distance-point may be laid down in any direction, up or down, on the right hand or on the left, or it may be measured in the direction of any of the corners —in fact, wherever it is wanted. In the present picture I have only used four. I have supposed the house outside to have its side parallel to the plane of the sheet of glass. The end of the house with the windows in it is therefore at right angles to the plane of the picture; and all horizontal lines on it, such as the tops of the windows, the sills and bars, vanish in *C*, the centre. I have made the roof slope at an angle of 45°; therefore the roofs painted on the glass vanish in the two *D*'s, the nearer sloping up towards the upper *D*, and the farther roof vanishing down towards the *D* underneath the centre. The diagonal squares on the pavement vanish towards the *D*'s on the right and left, because the sides of them are at an angle of 45°. By means of the diagonals we are able to measure any distances we may wish along the foreshortened side of the house. If the man goes on drawing the view towards the corners of the glass, making his picture take in a wider angle, the picture will look strangely distorted when it is seen from a little farther back. You will notice the lower squares seem to be pulling out into rather long, queer shapes when they are far away from the centre, though they would look quite correct from the man's own point of view, for the lop-sided lozenges drawn upon the glass will seem square when seen foreshortened.

On the next page there is a picture of the house as drawn by the man.



Albrecht Dürer nearly four hundred years ago made use of a glass mounted in a frame with a peep-hole fixed before it to enable him to draw more correctly. I only came across this old wood-cut by chance. I introduce it to show the pains he took to train his mind and eye.



Distance-points can be used in a great many different ways, as, for instance, to draw a bird's-eye view from an inaccessible point. In this case I have taken a map of a seaport, and have covered it with squares of equal sizes. I have coloured them like a chess-board, to prevent confusion between one square and another. Before squaring, be careful to select the best point of sight, and keep your chess-board parallel to the plane of your picture. Then divide a base-line along the bottom of your sketch into as many equal parts as you have squares along the side of your map, and from each tick run lines away to your centre ; this you will have placed at such a height as you consider best for your purposes. In the present drawing, if we suppose the chequers on my map to be 1000 feet square, then my point of sight is 1500 feet above the sea, for the horizon is a square and a half above the base-line.

When you have ruled all the lines to the centre *C*, start as many more from the same ticks to the distance-points away outside the edge of your picture. This *D* may be as far out as you like, but you will bear in mind that a long distance-point will make your picture look right only when it is seen from a good way off. On the other hand, too short a distance-point will cause your picture to look very distorted, unless it is held quite close to your eye. These lines to *D* are really at 45° to the lines running to *C*; so, whenever they cross each other, rule some more lines parallel to the base-line.

Where the lines to *C* cross the last of these,

run more lines diagonally to *D*. You can go on making a zigzag into infinity, until the whole surface of your sea is covered with measured distances. After this you have only to trace out on your perspective drawing the outline of your map, and the size of the squares will serve to give

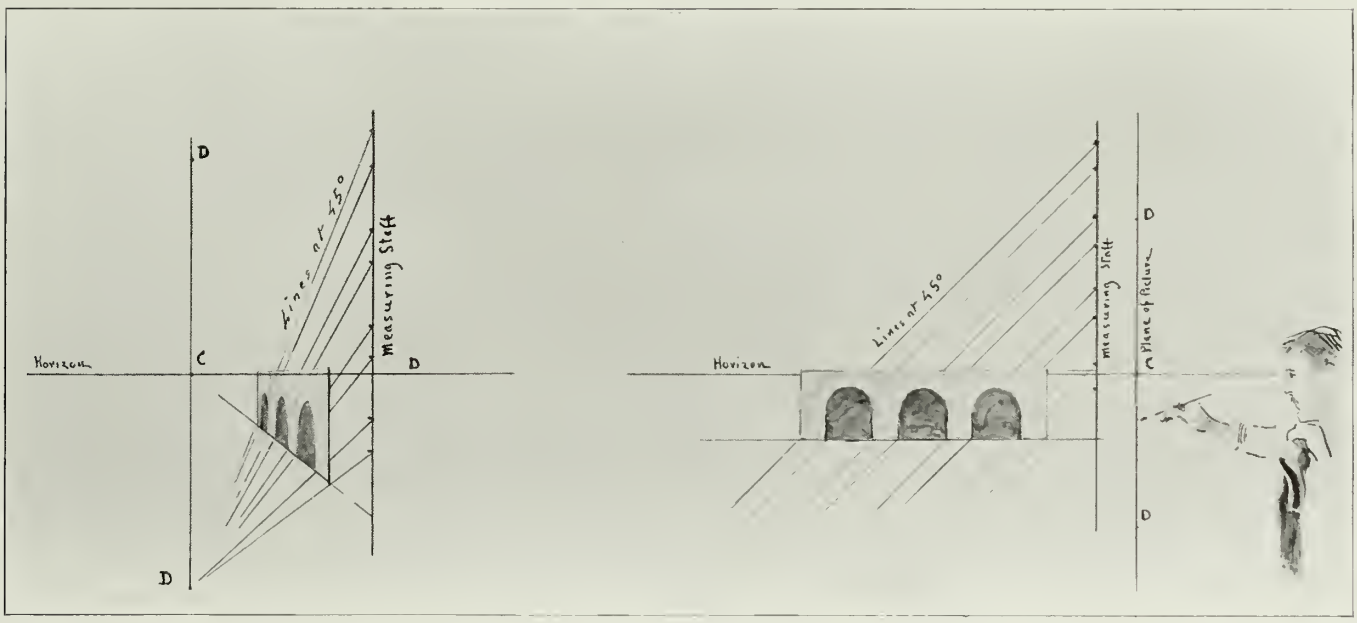
the right scale to the ships and other objects you may wish to introduce. At an elevation of 1500 feet the round of the earth's surface would be well marked. I have kept the visible horizon a good bit below the real one, and the more distant zigzags ought to be flattened also.

Wherever you have vanishing lines in a picture at right angles to its plane, you will always be able to cut distances along them by using one of the *D*'s. The *D* over or under the centre can be used to measure distances along upright surfaces, in the same way as the *D* at the side is used to mark off equal spaces on horizontal surfaces.

There are a great many ways of drawing columns, railings, or, in fact, any objects which have to be equally spaced.

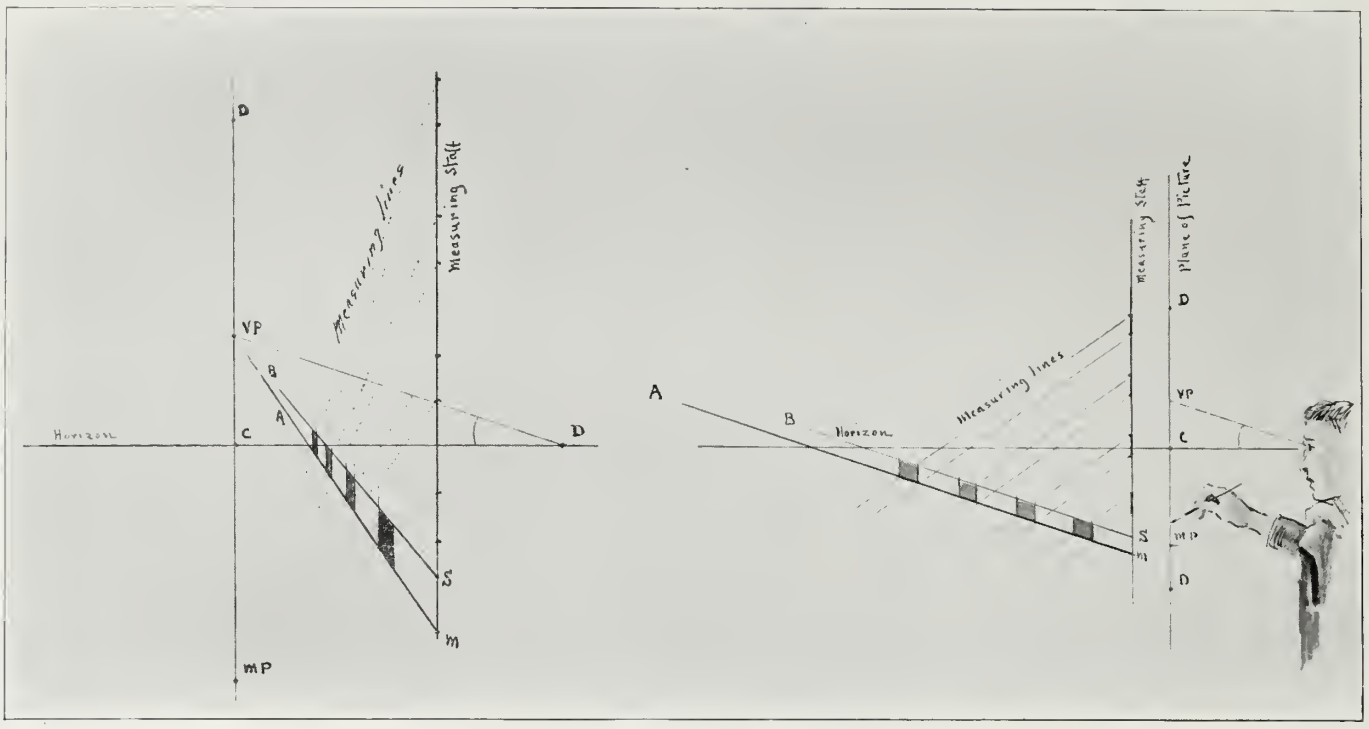
In the present drawing I ruled squares of equal size on a picture of a frieze, and drew an equal number of squares in perspective, using the *D* over the centre for this purpose, though the one underneath would have served equally well.

I began from the nearest end of the frieze, which I divided into five equal parts with four ticks. From each of these I ran lines away to *C*, then five more lines to *D*. Where these crossed the lines to *C* I ruled five more upright lines, and so on, working zigzags all down the line. After all the squares are drawn, you may colour them, and also the squares on the original, to prevent your losing your place, and then all you have to do is to trace the horses and warriors bit by bit. You will notice here that my distance-point is rather too short, and the result is a great difference between the sizes of the nearest horse and of those beyond. For most purposes it will be better to keep *D* farther away from *C*.

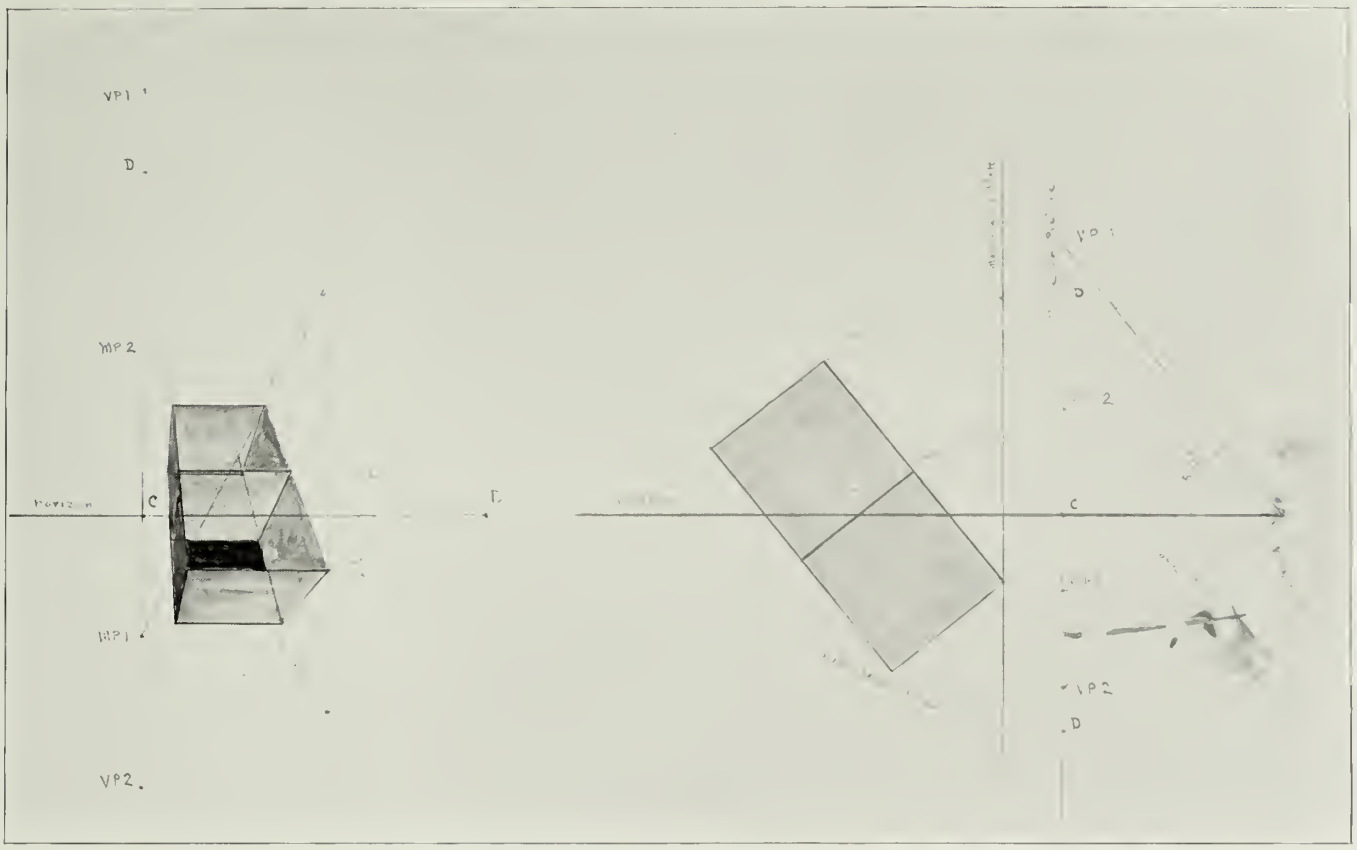


In the next three plates I have drawn diagrams on the right, showing in profile the object to be drawn, the plane of the picture, and the artist at work. On the left is the finished drawing, just as it would appear from the painter's point of view; he is drawing on the window-pane as before.

The bridge outside will appear to him foreshortened, and the nearest arch will seem much larger than the middle one, whilst the middle arch also will look a bit larger than the far one. The horizontal lines will all appear to run towards *C*, the centre, which is the nearest part of the glass to his eye; and the lines at 45° will vanish in the point *D*, the distance-point, which is the vanishing-point of all lines at an angle of 45° to the plane of the picture. This being so, it will be possible to construct a drawing which shall look absolutely correct when it is seen from the right point of view. First we will rule the horizon and mark the centre; under this we will mark a *D*, taking care that the distance from *D* to *C* is a suitable one for the purpose for which the drawing is intended. By the way, it may sometimes be more convenient to use a *D* at the top instead of underneath, but this will not affect the look of the drawing in any way. Next we will rule a line which is technically known as a measuring-staff. As you will see by the diagram on the right, it is always parallel to the plane of the picture. It may be placed in any convenient position. On it you mark off the spaces you wish to project—they may be in feet, inches, or to any scale you may wish—starting from the point where the base of your bridge, continued towards you, cuts the staff; from these marks you have only to rule a number of lines to *D* (see left-hand diagram), and where these intersect the base of the bridge, mark uprights. A line through the crowns of the arches will run to *C*, as will also all the courses of brick.



If the man draws on the window-pane sloping lines with equal spaces marked along them, such as I have drawn here, the two lines *AM* and *BS* will appear to his eye to vanish in the point *VP*. You can find this point by ruling a line from the eye to the plane of the picture, parallel to *AM* and *BS*. If, however, we wish to mark off equal spaces along *AM*, it will no longer be correct to use lines to *D*, because *AM* is not at right angles to the measuring-staff. We must therefore find a measuring-point which will enable us to transfer divisions marked upon the staff to the vanishing lines. This is done as follows. Take the distance from *VP* to the eye, and with a sweep of your compasses strike an arc from the eye to the plane of the picture. This gives *MP*, the measuring-point of *VP*, and because the distance from *VP* to the eye is equal to the distance from *VP* to *MP*, therefore all spaces marked along the measuring-staff can be transferred to the line *AM* by ruling lines to *MP*. All these measuring-lines which I have ruled parallel to the line from the man's eye to *MP* will appear to him to vanish in the measuring-point. When we apply these rules to a perspective drawing, it is not necessary to work out from an actual eye standing out from *C* at some distance from the surface of the paper, unless it be to make the principles more plain to a student. In practice we need only mark off the distance from the eye to *C*, and this, as I have already said, will give us the distance-point. This *D* may be set off in any direction from *C*, according to the needs of the drawing. In the present case *AM* is sloping upwards; I have therefore used *D* on the right of the centre, though *D* on the left would also give the same result. At *D* you rule a line with the same slope as *AM*, and where this cuts a perpendicular from *C* you will mark your vanishing-point *VP*. You will rule your lines *AM* and *BS* at any convenient place, and at *M* erect the measuring-staff and scale. Then take the distance from *VP* to *D*, and sweep in an arc to a perpendicular dropped from *C*, and this will give *MP*, the vanishing-point of all the measuring-lines. Where these cut the line *AM* you will mark your spaces. If you can once grasp the principles which are involved in making this small drawing, you will find the rest of perspective quite easy to follow. I would advise you to make several drawings of such a diagram before you pass on to the next lesson, sometimes laying the line down on the ground for a change, and making use of vanishing-points and measuring-points laid off along the horizon.

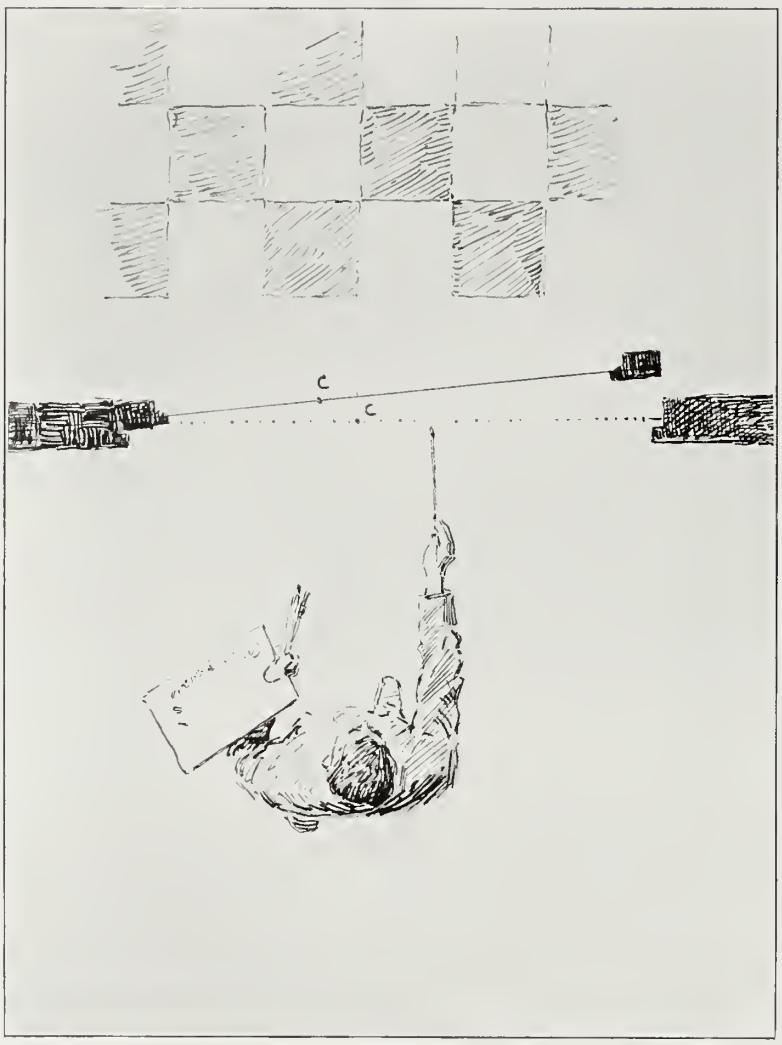


I will now suppose that our man draws on his window-pane a box tilted up at an angle of 50° with the horizon. The sides of the box will seem to his eye to vanish in a point on the plane of the glass which I will call *VP*1. To find this point I simply measured off an angle of 50 at the man's eye. I will suppose the box to be 2 feet long; so we must, if we want to measure it correctly, find a measuring-point for *VP*1. So, sticking the point of the compasses in *VP*1, we strike the arc from the man's eye to the plane of the picture. This gives us *MP*1, and with a measuring-staff marked with 2 feet it will be easy to run lines from the marks on the staff to *MP*1. If we suppose the ends of the box to be at right angles to the sides of it, we must find a vanishing-point for them. To do this we need only draw another line from the eye to the plane of the picture which will stand at right angles to the line from *VP*1 to the eye. *VP*2 will be marked where this line cuts the plane of the picture, and is the vanishing-point for all lines at an angle of 40° below the horizon.

In the plan, of course, we need only draw the end of the box at right angles to the sides, top, and bottom, but in the perspective drawing the ends will vanish down towards *VP*2.

Now suppose the box to be 1 foot wide and 1 foot deep. The width is easy to measure, because the top line of the end of the box is parallel to the plane of the picture—that is to say, the window-pane the man is drawing on. We have simply to take a foot on the measuring-staff, and carry it away at right angles along the end of the box. When it comes to the depth, we must, if we want to draw the ends correctly, find a measuring-point for *VP*2. One point of the compasses must be stuck in *VP*2, whilst the other point strikes an arc from the eye to the plane of the picture at *MP*2. The measuring-staff will then be marked with a foot, and the line ruled to *MP*2 as before.

Although in this case I have made the measuring and vanishing points above and below the horizon, they can be quite as well used to the right and left, or indeed they may be used diagonally if needful. If the vanishing and measuring points are used along the horizon line, the measuring-staff will be laid down horizontally. In this case you may call it a base-line.



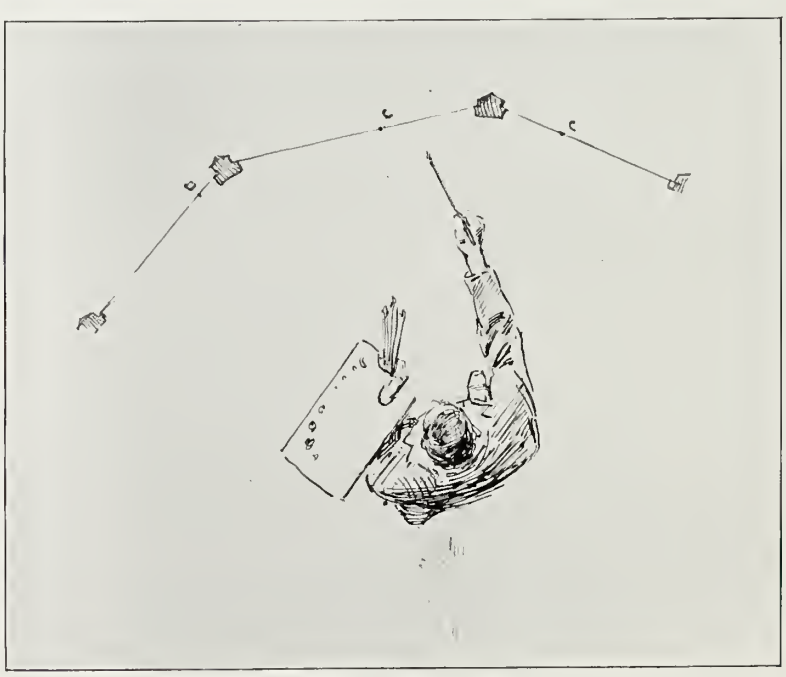
Should you ask for a definition of the centre, you will often have very strange answers. "Oh, it is a point opposite your eye," or, "Well, it is the centre of vision." What that may mean I cannot say, for your eye moves from one part of the picture to another whilst you look at it; and every part of this surface may be said to be opposite your eye just at the moment you are looking at it.

The centre is a fixed point on the plane of your picture. It is the nearest part of that plane to your eye, and cannot be moved from its place except by moving the plane itself, or shifting the position of your eye.

Let us suppose our man draws on the window-panes of a bow window. He will have a fresh centre for each pane of glass, for the side windows are at an angle to the middle one; but each centre can only be in one spot, viz. the nearest point to his eye on the surface of each sheet of glass.

If some one should open the window a little whilst our man is drawing on it, the centre would be moved away to a fresh point on the left, and his sketch would have to be rubbed out and begun again, as I will now show you.

When the window is shut the sides of the squares at right angles to the glass will vanish in the centre, and the sides of the squares parallel to the glass will be simply ruled straight across. If, however, the window is opened a little and the plane of the glass altered, the squares, though they would still look just the same from the man's point of view, would have to be represented differently on the glass. The sides of the squares, which were ruled straight across in the first case, must now vanish to a point a long way on the left, and the foreshortened lines, which vanished in the point nearest to the man's eye on the glass, now no longer do so, for the glass has changed its angle, moving the centre more to the left; so we must now call the point *VP*1 or 2. The square on the right must now be drawn larger than those on the left, which grow smaller and smaller the farther they are from the plane of the picture.



Here are three drawings to show how a scene is changed in appearance by canting the plane of the picture.

In the first one I have supposed the centre to be at the foot of the flagstaff on the distant jetty. I have fixed on this point because the lines of the foreshortened sides of the buildings appear to vanish there. The plane of my picture is therefore parallel to the edge of the quay, and also to the ends of the buildings in shadow. This being so, I have only to rule all their edges square across the picture ; and any equal spaces, such as lines of windows or bricks, need only be measured off equally along them, and the distance-point can be used for all the spacing of the windows of the foreshortened faces.

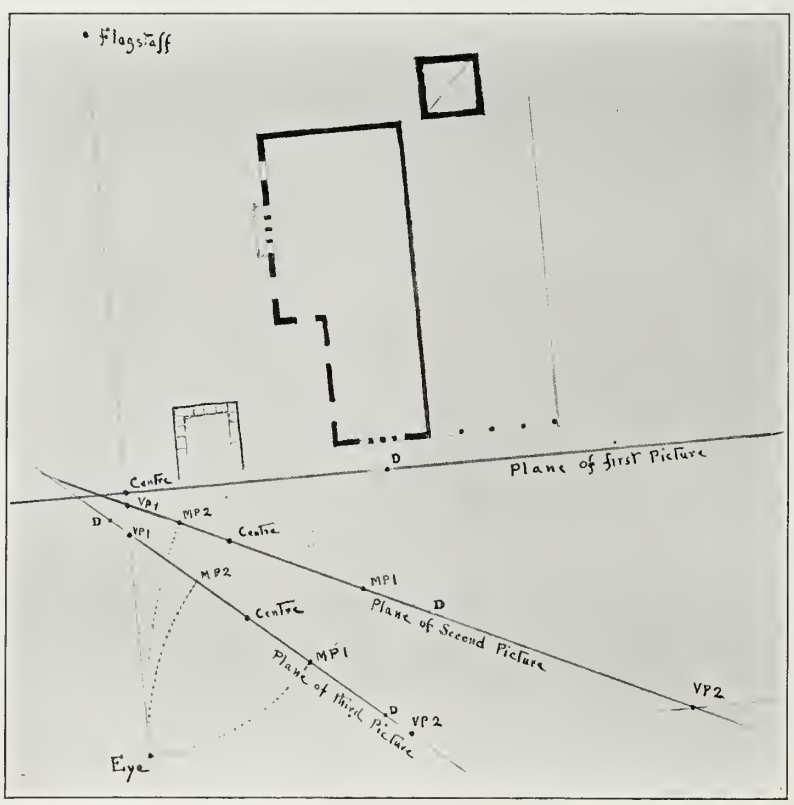
In the next drawing I have supposed the artist to turn a little to the right, slewing the plane of his picture round with him. The centre must of course move too. I will now suppose it to lie on the nearest pillar of the house in the middle. The vanishing-point under the flagstaff must now be called *VP*1, and to find *VP*2 for the quay-side and the near ends of the buildings, you must take a right angle at the eye, and this will cut the plane a long way out on the right. To cut equal spaces along the houses or quay, you must now use measuring-points. *MP*1 is just outside the edge of the picture; *MP*2 is marked with a star; it is just over the left hand of the man in the gondola. I have left all the measuring-lines used in the foreground, so that the reader may understand the method. They are very faint, but can be made out in a strong light.

You will sometimes see a drawing of buildings where the centre is placed quite near to the edge of the picture. This is not a very good place for it, because a drawing made in this fashion can only look correct when it is seen obliquely, and people as a rule stand in front of a picture when they look at it, not at one side.

If we turn once more to the right, slewing our picture plane still more, we can still draw our building from exactly the same point of view, but everything must be changed, because the centre is in a new position. The nearest point to your eye on the imaginary sheet of glass on which I will suppose this last subject to be drawn, is the opening in the door at the head of the stairs in the middle of the sketch. *VP*1 at the foot of the flagstaff is now a long way to the left, outside the limits of the drawing; the measuring-point for this line is just over the stern of the boat on the right. *VP*2 is away on the right, not quite so far out as it was in the last drawing, but still a good way beyond the edge of the sketch. Its *MP* I have marked with a circle; it is on the second pillar of the house on the left. You will be able to find all the lines and scales I have used to construct the buildings; some of the scales or measuring-staffs are in the sky and the others are on the water, but in each case you will notice that they are ruled right across parallel to the plane of the picture.

In order that these three drawings should be constructed correctly, they had to be pinned on to a large board. *D* was measured off overhead, and the vanishing-points and measuring-points found. You will notice in many places the marks of the base-lines and measuring-staffs used to space the windows, pillars, and posts, and to keep the tower square and not longer on one side than the other.

Perhaps I can make this more clear with a diagram. In the upper part of it is the ground plan of a building with a square tower beside it, something like the last three drawings. Near the lower left-hand corner I have marked the position of the observer's eye. From this I have ruled a number of lines to all the corners of the building, and I will ask you to remember that, as all these lines are seen end on, they will appear as dots on



the drawing. Across these I have ruled three straight lines to represent the planes of the three pictures. The upper one, you will notice, is parallel to the ends of the houses and quay, and at right angles to the line that runs from the eye to the vanishing-point at the foot of the flagstaff. We may therefore call this point the centre. All the lines on the foreshortened sides of the houses will vanish in it, and to cut equal distances, such as the windows and pillars, we can use the distance-point *D*. This will also help us to make the two sides of the tower of equal width, so that the tower shall look square and not oblong.

In the next picture the artist is supposed to turn a little to the right, canting his picture plane with him. The centre moves too, and as the building is in no part of it parallel to the plane of this new picture, we must find vanishing-points for the two sides we see before us. To do this, we must rule a line from the eye parallel to the long front of the house. This is a line in the plan, but in the sketch it appears simply as a dot just underneath the flagstaff. We will call it *VP*1. If you rule another line at the eye at right angles to the last one, it will give you the vanishing-point of the short face of the house.

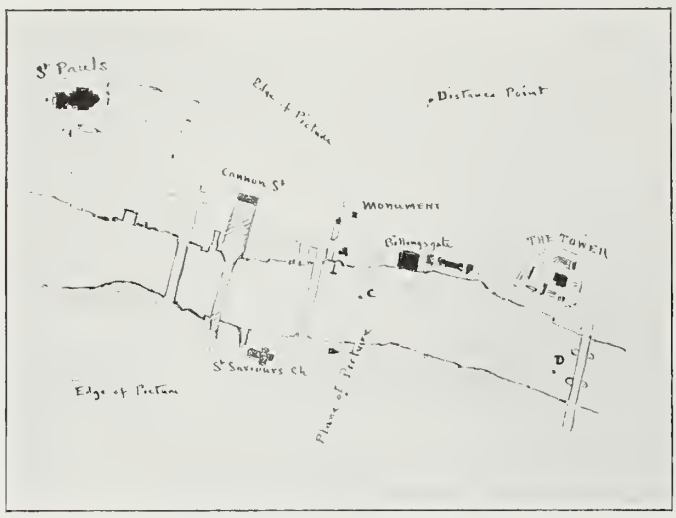
This will be a long way on the right ; we will call it VP_2. You will find both VP_1 and VP_2 marked on the plane of the second picture, and also the two measuring-points, and one of the distance-points, its fellow D being on the left, outside the plan.

I have ruled the plane of the third picture a little more inclined to the right, and have also kept it a little nearer the eye, in order that the three planes should be kept clear of each other in the diagram. The effect of this shortening of the distance-point is simply to make the resulting drawing a little smaller than the last drawing.

Here is a rough design for a picture. It is built up from a number of studies and drawings made at different times, and no doubt some of the sketches were taken from objects too near, and others from too far off, for their position in this composition.

So long as it remained more or less a rough idea for a picture, and not a finished work, it might be possible to fudge along, using only eye and rule of thumb for the proportions of the craft, men, buildings, and bridges.

The moment, however, I tried to carry the sketch further, I found that I must fix my distances



by proper rules; so I got a map of the City of London, and by ruling lines from St. Saviour's Church and the Monument to the spot from which I had taken the original sketches, I found my distance-point. It is marked on the little map introduced here, and you will notice that it is simply the distance from *D* to *C* laid off along the plane of the picture.

When it came to transferring *D* to my canvas, I had only to make the distance from *D* to *C* bear the same proportion to the width of the picture as it does in the map. Then nailing the picture to the floor, face up, I put a bradawl in the place where *D* should be, and with a chalked string covered the whole surface of the water with squares of equal size, as in the next plate. Then I made a plan of the whole forefront of my subject, also covered with chess-board squares, on which I traced carefully the water-lines of all the craft in the picture. In the cases where these

were too long, or seemed twisted or out of position, I made them right, and then I corrected the picture from the plan.

By means of *D* I could also find proper vanishing-points for all my buildings, besides making sure that the keels and beams of my craft were at right angles to each other.

Now all this ruling of lines and measuring of

distances may sound very terrifying to any one who has never tried it. In fact, however, it is not at all difficult, provided you understand the principles. And the day or two lost in working out all the positions of your craft and buildings is time well spent. It would, I believe, be quite impossible to represent such a scene correctly without rules of this sort to guide you. It was convenient in this case to make the squares the same width as the barges, and three squares equal to the length. In this way I could add more craft in any part of the picture, and yet make sure of drawing them to scale.

bearing of lighthouse NNE
Direction of Wind
Course of Battle Ships SSW
Direction of Vanishing point of ripples
Direction of Vanishing point of ships yards beams ab WNW
D

I was once asked to paint a picture of a squadron of war-ships steaming in three columns. The size of the men-of-war, and the proper spaces between the divisions, were all given me, but it was at the time quite impossible to paint the subject from nature, because the ships were at the moment all

in different parts of the world. I therefore made a plan to scale of the vessels in the required position, and after trying different ways of projecting the plan on to the plane of my picture, I hit on the following method, which, so far as I know, is quite new. The first thing to do was to select a good point of view, and, after one or two trials, I settled on the point *D* marked near the lower edge of the plan. This point, once fixed, ties you down to the direction from which all the ships must be seen, and also to their relative sizes. If *D* were farther back, the ships would be more of a size. If *D* were closer in, the nearest ship would be very much larger, and the others less in proportion. The plane of the picture, being at right angles to the surface of the sea, can be represented on the map by a line. It was convenient in this case to make the line coincide with the horizon of the picture I was going to construct, because I could fix the positions of all the vessels by simply ruling lines from *D*, which in this case represents the eye of the spectator, through the ends of the ships, on till they reach the line representing the plane of the picture. In this way you have at once the proper length of all your ships marked all along the horizon. The next thing to do is to find out the point to which the fore-and-aft lines of the squadron will vanish. To do this it is only necessary to rule on the plan a line from *D* parallel to the course of the ships ; where this line cuts the plane of the picture you will mark a point to which the lines of ships will vanish. I have marked the spot with a lighthouse, which I will suppose to bear N.N.E. Now we must find a vanishing-point for the yards, bridges, beams, and all lines which are at right angles to the course of the squadron. This is done by ruling a line on the plane at *D* at right angles to the course of the battle-ships ; then prolong the horizon to the left, until it cuts this line, and you will have the point required. It will bear W.N.W. from *D*.

The next thing you have to do is to decide at what height you would wish to place the eye of the spectator. You may fix any position you please. If your eye is level with the foretop, all the tops will be cut by the horizon. If it is level with the bridge, all the bridges in the squadron will come up to the horizon. In the present case I have supposed the eye *D* to be just above the decks of our battle-ships ; you can therefore begin drawing our nearest vessel in the space marked off by the rays from *D* through the ends of the ship marked in the plan. You will keep the line of her deck just below the horizon, and vanish all fore-and-aft lines to the lighthouse. These fore-and-aft lines will cut through all the ships astern in the same way, all the mastheads being on one line, all the funnels on another, and so on. The yards and bridges will vanish towards the point a long way on the left, and which bears W.N.W., and this point will enable you to draw all the ships on the left in proper proportion ; the yards and beams of the ships in the near column being in the same vanishing line as those of the farther column. If you rule lines on the surface of the sea through the stems of the ships to the vanishing-point of the yards and beams, you will make the whole squadron appear to "keep station."

If you wish to give a look of reality to the ripples, you may vanish them away to a point on the right. I have also in this drawing found a point at right angles to it on the left as a vanishing-point of the wind, and have made the clouds run towards it. You will notice, however, that the smoke from the ships' funnels and the signal flags do not vanish towards this point, but to another much more to the right. This is because the speed of the ships through the air would draw the apparent wind more ahead, and cause the smoke and flags to vanish in a point farther aft. I have marked the spot with a round fort.

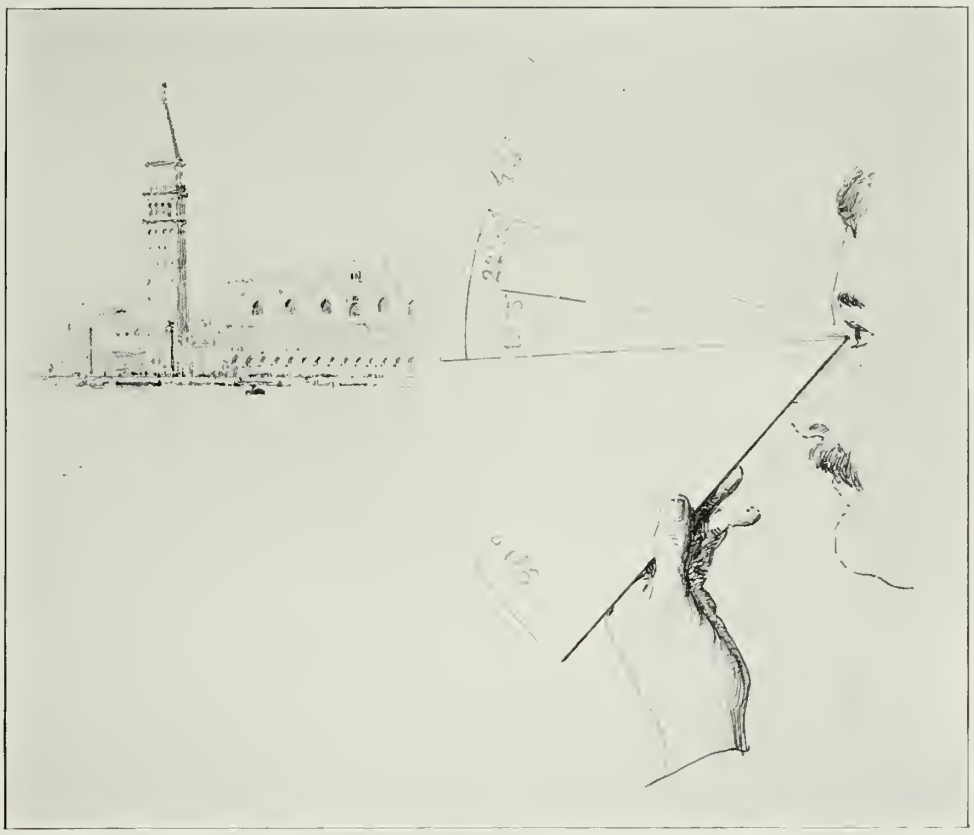
This method of projecting a plan directly on to the picture may be found useful for many other subjects—processions of all sorts, artillery waggons, teams ploughing, troops on parade, or for that matter in action, for often in painting a battle we have only plans and descriptions to construct from.

It is only after a little practice that you learn to choose a good position for the *D*, the point of view. I may also remark that the horizon I used to construct the picture is now rubbed out ; it was a fraction higher up than the present line.

This little drawing of two battle-ships looks very like the snapshots one sees taken with cheap pocket cameras. The twisted, distorted appearance is due to its small size and the wide angle subtended by the picture, but you have only to keep *D* a little farther away to make the picture fairly pleasing.

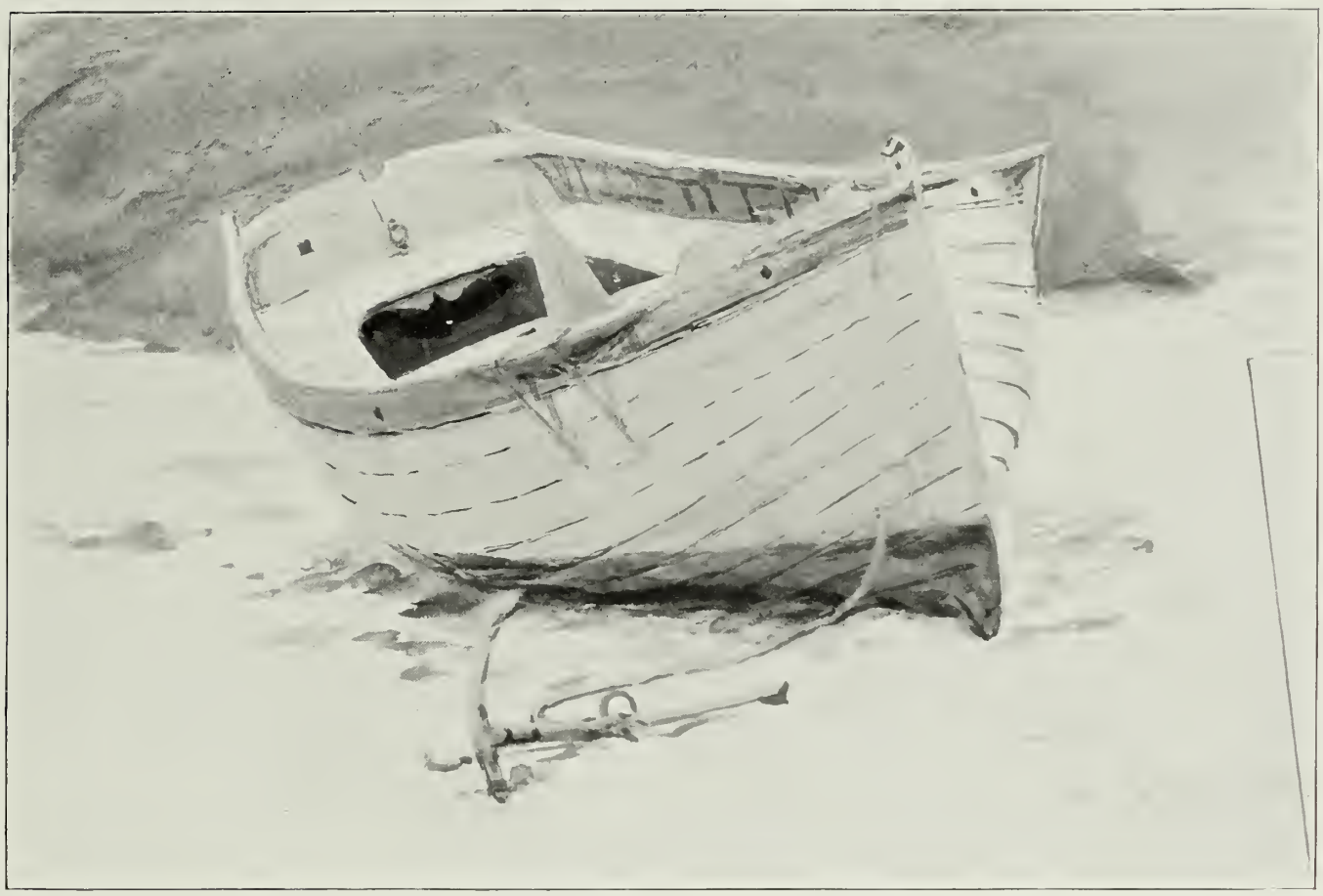
I have supposed that a drawing of two foreshortened ships had to be constructed, but that we only had the sheer and body plan to work from.

The first thing to do is to draw the two profile vessels along a base-line. One of them is rubbed out now, but you can still see the marks of the stem and stern, and the dots where her masts were stepped. I will assume that the keels had to be drawn at an angle of 32° with the centre-line of the picture. All we have to do is to rule a line at *D* at an angle of 32° ; where this line cuts the horizon we will mark *VP*1, the vanishing-point of the keel and all the fore-and-aft lines. Take the distance from *VP*1 to *D*, with a sweep of your compasses down to the horizon. This will give you *MP*1, by means of which you can transfer all the points along the base-line—stems, masts, funnels, etc.—to the middle line of your ships. You can transfer the heights of tops, yards, and bridges in the same way. To make the yards and bridges look square, you must draw a line from *D* at right angles to the line to *VP*1, and where this cuts the horizon you will mark *VP*2, the vanishing-point of all beams ; and the distance of this last point to *D*, taken down to the horizon, will give you *MP*2, by means of which you can transfer the correct width of the ship from the base-line to the fore-and-aft line of the ship near the funnels. The yards, the tops, or indeed any part of the vessel, can be measured and drawn in the same way. When once you have your vanishing-points and measuring-points, the rest is simply a matter of taking pains.



Outside the shop where the immortal Captain Cuttle kept watch over the stock-in-trade of Solomon Gills, a wooden midshipman stood, eternally taking observations of the hackney carriages. When you are trying to draw a difficult subject, you will often find it a help to make yourself a sort of rough quadrant like the midshipman's, with a leaf out of your sketch-book, or any square bit of stiff paper, which you can hold up to your eye to measure angles with. The side and lower edge of the right angle may be folded together, and will give you 45°. Fold this again, and you will have 22° 30″. Fold it once more, and you will have 11° 15″. Tear off the superfluous paper and leave the shape of a fan, and you will be able to take a number of measurements, which will help you considerably both in drawing what you see before you and also in after days when you are building up a picture from a number of studies painted at different times. Always press the corner of the paper quadrant close into the eye when you are using it, or else the angles will not be measured correctly. As an example of the first, we will suppose you are painting some great building covered with complicated detail. It will be necessary to use vanishing-points for the two sides of it, and though it is not a very difficult task to guess where the sharply foreshortened front on the left will vanish, yet when you try to fix a place for *VP*2 on the right, you will find it by no means easy to make it correspond to that of the real building you are trying so hard to draw. In despair you may at last try to work by eye alone; but eye alone will only result in a knock-kneed, gingerbread sort of a pile, with corners never quite square, and towers more or less lop-sided. If you hold up your little paper quadrant to the building you are sketching, you can with a little care find out the angle it subtends, and this at once fixes your distance-point. When you have this, you have only to fix the picture on its back in a long room, and knocking one nail in for *D* and one on each side for *VP*1 and *VP*2, you snap in all the vanishing lines with a chalked string. It is also a good plan to write on the back of your picture the length of your distance-point, in this way—*D*, 7 feet 10 inches—so that you can refer to it at any time.

When you make studies of objects from nature —carts and horses, buildings, boats, or gear of any sort—you will find that the block or board you are drawing on can be used to take the angles your objects subtend ; and a careful drawing of any sort should have a sector drawn in the corner, showing the number of degrees of arc taken in by the object. As an instance of this, I give two studies of the same boat. In the first I was fairly near —7 yards from the stem, which is therefore large. The bow, you will notice, looks much sharper, and the stern narrower, than in the second drawing, which is taken from 14 yards off. Here everything is a little changed, the stem is less in propor-



tion, and the bow swells out fuller, whilst the stern is much wider. The angle subtended by each is marked in the corners of the drawings. You can quite understand that the first one will not look correct unless introduced large in a picture, whilst the second could be used much smaller. If I wished to use these drawings in the extreme distance of a picture, I would have to alter and adapt them considerably before they would look correct, filling out the farther bow, cutting down the stem, and widening the stern. Notice that the anchor shrinks, as you move away, much more than the stern of the boat.

Here are two drawings of a church—one, a wide-angle picture drawn from quite close to it, and in consequence having the vanishing-points close in to the edges of the picture ; and the other, a narrow-angle sketch, taken from very much farther off. The vanishing-points have accordingly moved out much farther too ; and at the same time the relative size of the different parts of the church has altered very much. The spire is now very much taller in proportion, and the length of the nave shows very much less. In the corner of each view I have ruled a sector, showing the angle subtended by the width of the building. It would seem hardly necessary to put such drawings as these in this book ; but I have thought it well to introduce them, as I have so often noticed, in pictures or drawings, buildings such as the larger view introduced quite small in the background of a figure subject, without any regard to the perspective of the rest of the picture. I once saw a portrait of a sailor painted standing by the sea. He seemed—as far as one could judge—about 12 feet away, and was not distorted at all ; but there was a little battle-ship on the horizon ; she had a great stem and a very minute stern ; one mast was twice as tall as the other, and the foretop was drawn just as though your eye were looking up at it from only a few yards away. In point of fact, the ship subtended such a wide angle that to make the picture correct you would have to roll the admiral round, so that the top of his cocked hat touched the toes of his boots.

The two next subjects are each marked in the same way. The reader will understand how useful the sector in the corner would be, if I wished to add any object to either of the drawings. If, for instance, a tug with a tow of barges had to be put in large, I have only to mark off the distance-point on one side of my drawing, and in a minute or two I can mark off the length of my foreshortened craft in any part of my picture. In fact, it is much more easy to draw them by rule, than to try to make a hasty shot at them as they steam by. The sector in the corner will also prevent these little drawings being used as part of a larger composition, where they would look utterly out of place and wrong. If you want to make studies that are intended to be used for this purpose, they should embrace only

a narrow angle. The circular drawing is inserted here to give an idea of my meaning. It only subtends 2° of arc, and therefore might form part, just as it is, of a picture 20 feet long. In point of fact, it looks almost a caricature of a narrow angle, and could only be drawn through a powerful telescope. You will notice that, though taken from 150 feet above the water, one does not look down upon the decks of even the very nearest barges, which are in fact quite two miles off, and that the curve on the surface of the world shows very much. The craft on the horizon, ten miles away, stand up quite large. There can hardly be said to be a vanishing-point for the waves to run to, or the vessels to sail

towards. In fact, to make the drawing quite right, you would have to stick it at the end of your garden, and look at it from the house.

Turner was the greatest adept at making pictures the world has seen. His wonderful knowledge of the laws of nature enabled him to build up and perfect those creations before which we stand and wonder. Of course a perfect insight into the practice of perspective is only one of the attributes of the accomplished artist. It is by no means indispensable, for we have often seen very beautiful work by men who knew nothing of its rules; but then they could only copy what was before them. The moment a change was made in the composition or the light and shade, there came possibilities of error on every side.

De Neuville, the painter of the Franco-German War, once told me of the infinite pains he took to make his battles correct, placing models on the actual scene of his subject, and drawing everything just as he saw it, even to unimportant distant figures. He told me at the time that he knew nothing of perspective, and I could not help thinking what a lot of trouble he might have

saved himself had he learnt it. Any one who gives his mind to the work can soon find out how to use the rules, and once he has mastered them, a little practice from time to time will keep them in his head.

The man who will not learn himself, but who engages a draughtsman to work out all the architecture for his picture, and then tries to make his figures fit in with it, often comes to the most awful grief. There are the lines of pillars or windows all nicely spaced and vanishing away in proper fashion, whilst the rest of the subject is built up without any reference to the building. Sometimes we may see a mosaic pattern worked out carefully, and the men or women standing on it without any regard to the measured spaces. Perhaps in one part of the pavement a foreshortened foot may be drawn as though it were four inches long, and a figure be represented in another part of the same floor standing quite unconcerned with a stride of six feet.

Then there is the painter who builds up his picture partly from photographs and partly from nature. If he does not understand perspective, he is surrounded on every side by pitfalls. I spoke a little while back of an admiral with a battleship in the distance, but his case is not more wonderful than that of a celebrated architect who was represented standing by a window through which one saw a building twisted out of all likeness to nature by the violent wide-angle view which the artist had chosen. And strangely enough, though the town hall looked just as though it had been photographed quite close with a kodak, all the plans and elevations, which were spread on the table in the foreground of the picture, were painted just as though seen from quite a dozen feet away. The effect of the whole was quite bewildering. I could fill pages with descriptions of pictures and drawings of the same sort.

The painters of old thought a great deal of design and arrangement, never or very seldom attempting to reproduce the real appearance of flesh in the open air, or of brilliant sunshine upon sea or land; they trusted to contrast of colour and skilful treatment for their effect, not the slavish copying of absolute fact. Towards the end of the last century, when inventions of all sorts crowded in upon us, and our knowledge of all the sciences increased by leaps and bounds, there came a craving for realism, and in the struggle to depict nature with uncompromising truth, composition and design were often neglected or forgotten. In the present day there seems to be a tendency to return once more to the old ideas, though many of us still cling to naturalistic treatment. We are told that the art of the future will be a combination of design and realism, but if we wish to be capable of rising to such perfection, we must first train ourselves to a complete knowledge of Nature's Laws.

In conclusion, I must ask the reader to believe that all this was written to help painters to be masters of the rules of their art, not slaves to them. The subject is not an easy one to write about, and I fear I may not have put my facts as clearly as might be.

If I succeed in inducing my brother artists to think a little more of the useful but much-neglected science of perspective, my work will not have been in vain.

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